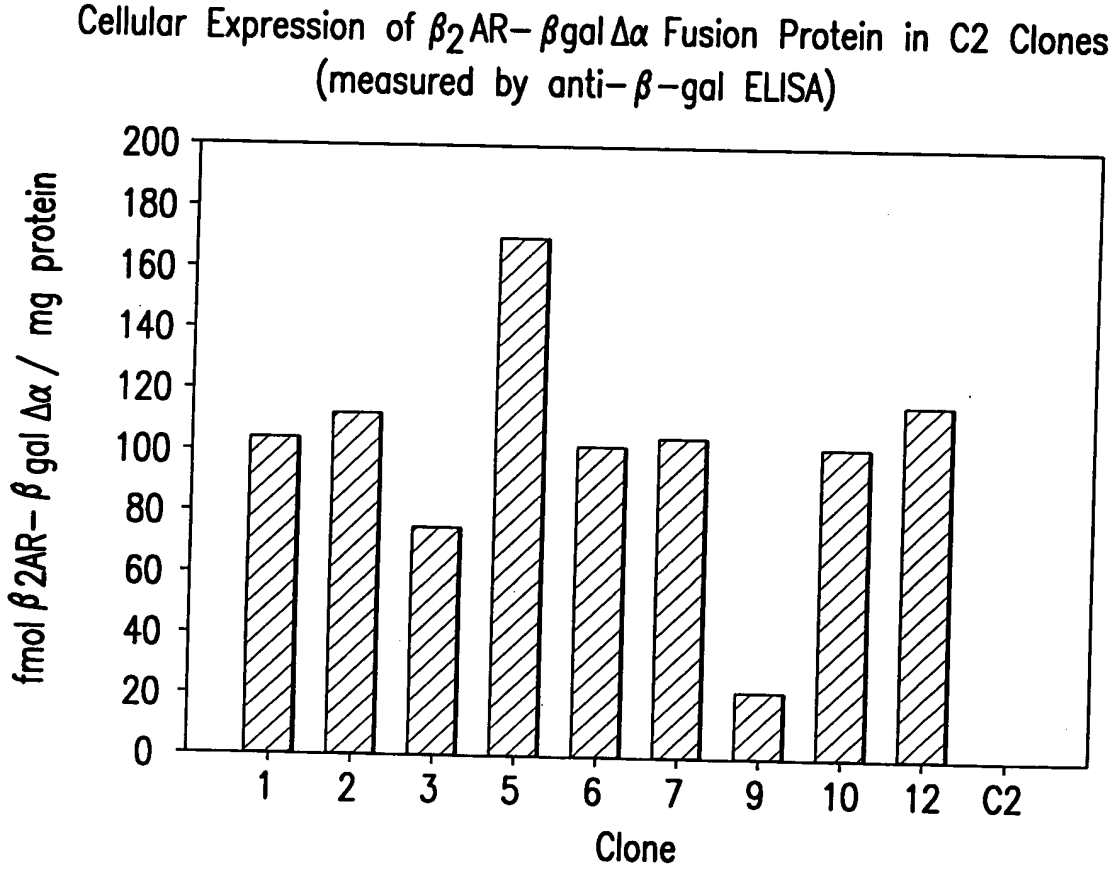

FIG. 1A

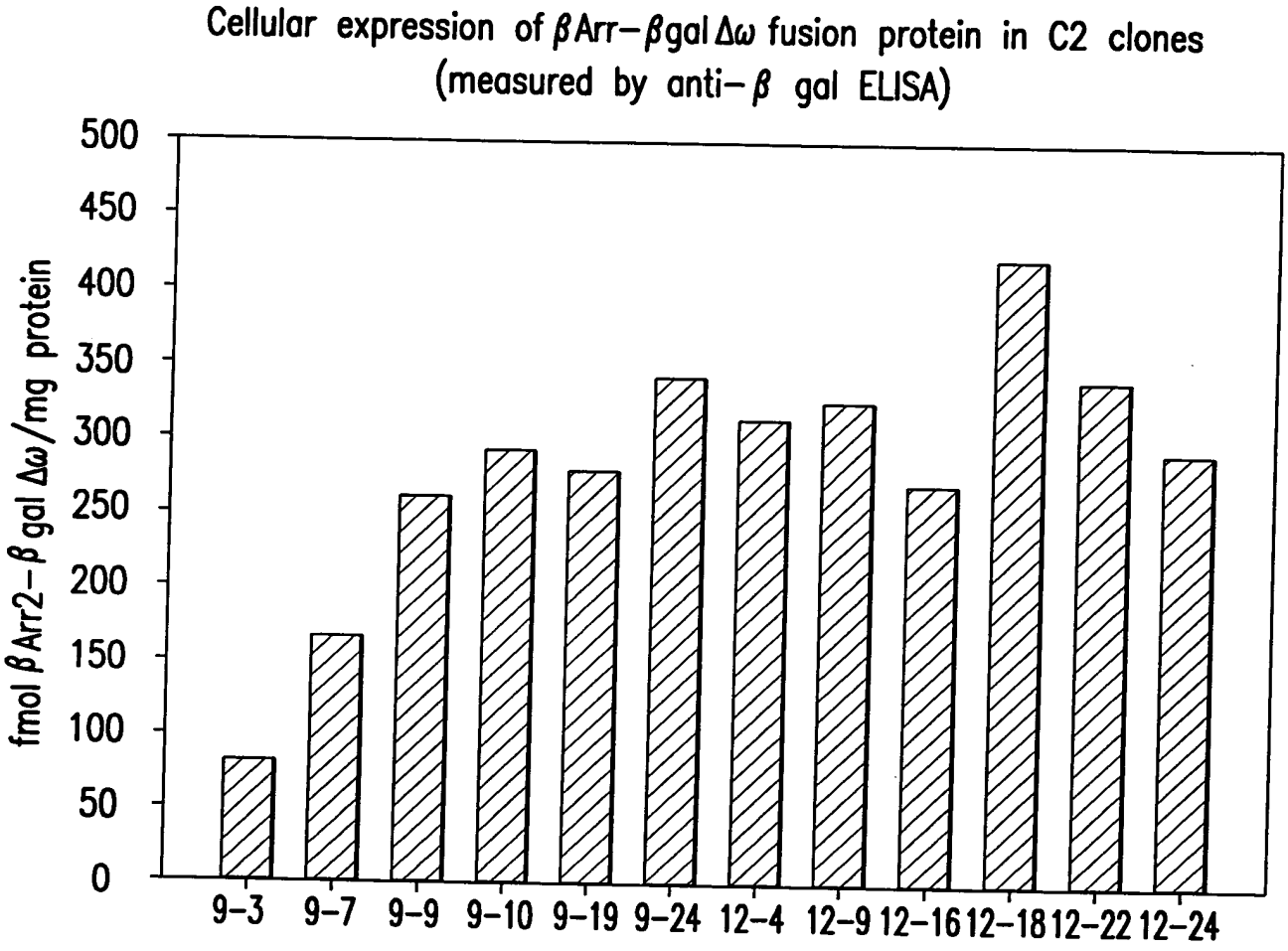

FIG. 1B

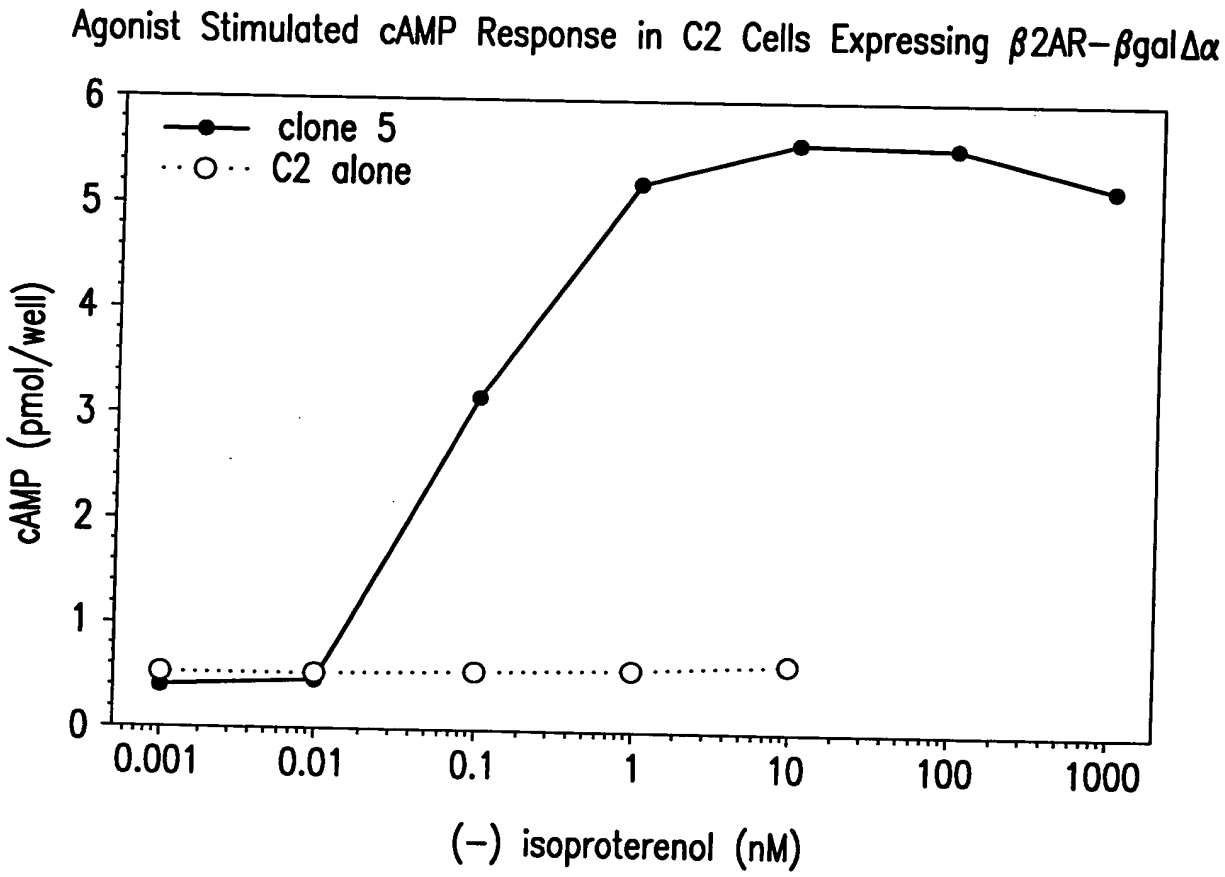

FIG.2

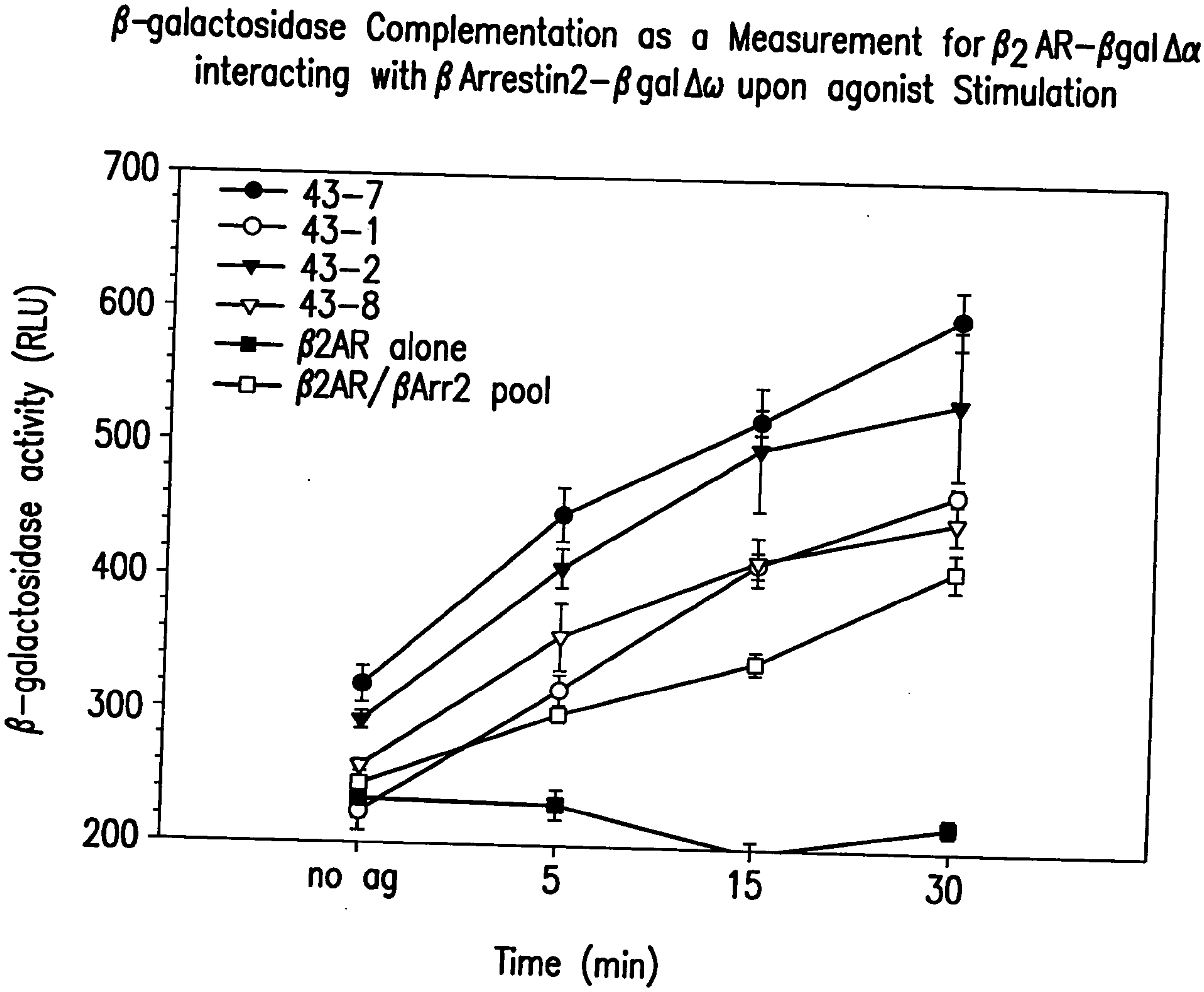

FIG. 3A

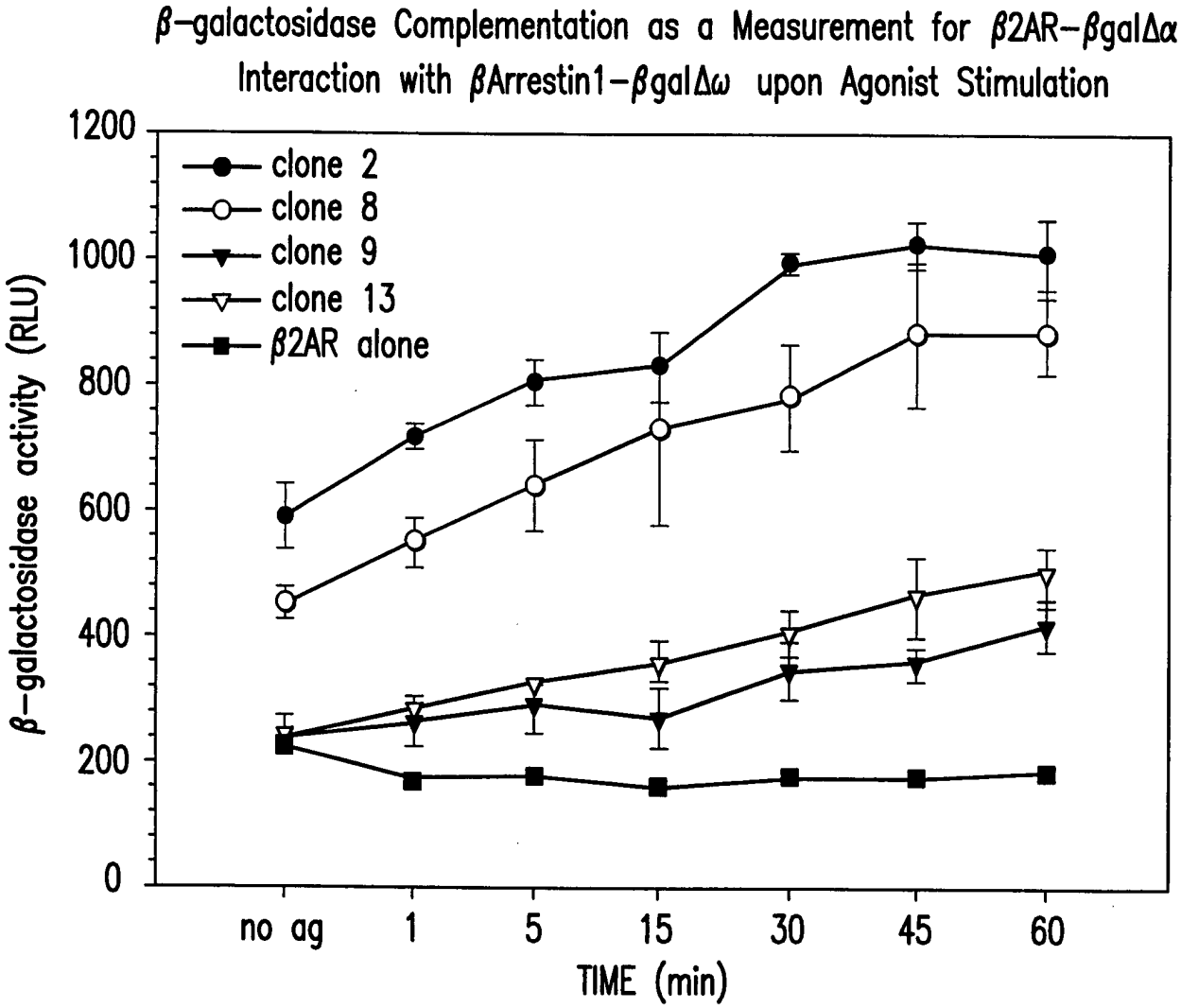
β-galactosidase Complementation as a Measurement for β2AR-βgalΔα
Interaction with βArrestin1-βgalΔω upon Agonist Stimulation
β-galactosidase activity (RLU)
1200
1000
800
600
400
200
0
clone 2
clone 8
clone 9
clone 13
β2AR alone
no ag
1
5
15
30
45
60
TIME (min)

FIG. 3B

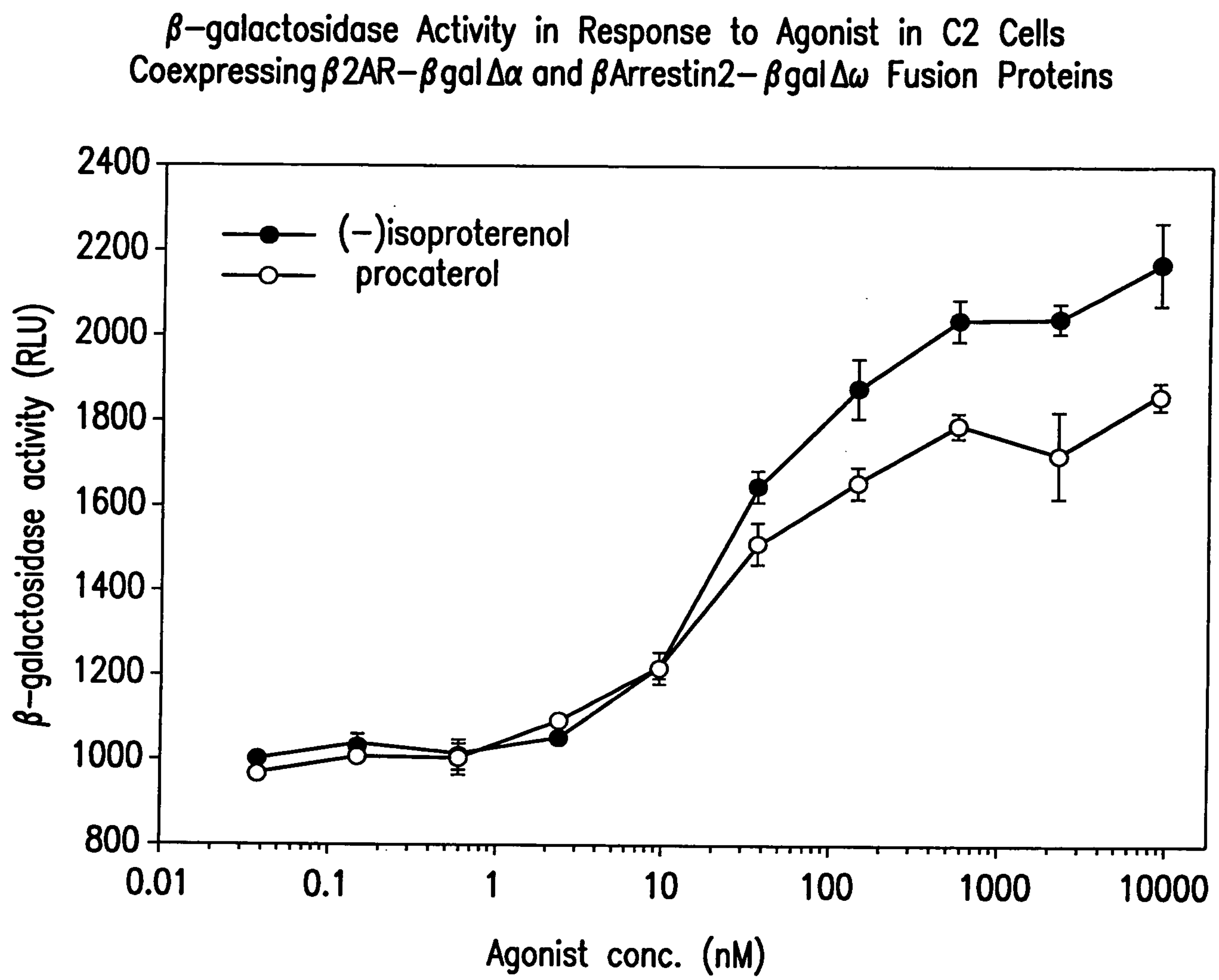
β–galactosidase Activity in Response to Agonist in C2 Cells
Coexpressing β2AR–βgalΔα and βArrestin2–βgalΔω Fusion Proteins
(–)isoproterenol
procaterol
β–galactosidase activity (RLU)
2400
2200
2000
1800
1600
1400
1200
1000
800
0.01
0.1
1
10
100
1000
10000
Agonist conc. (nM)

FIG. 4A

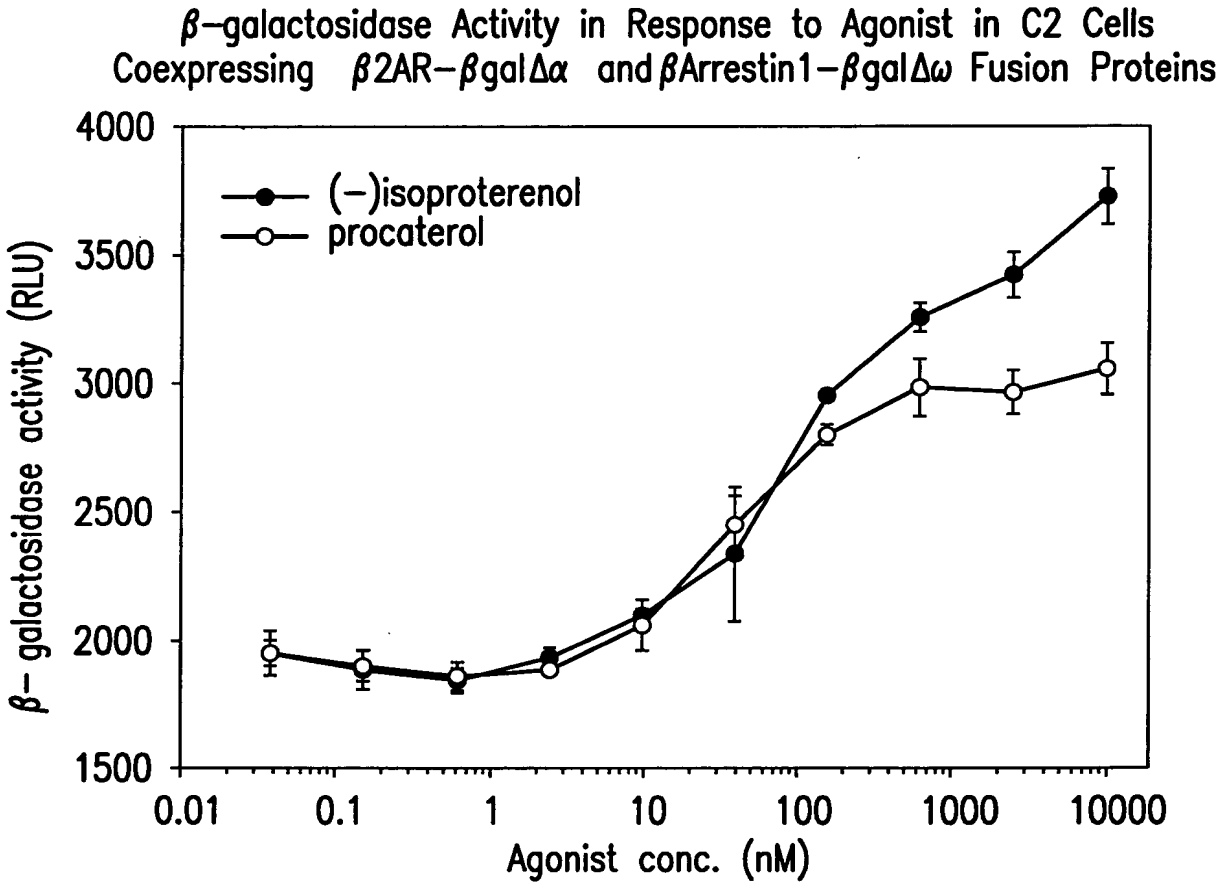

FIG. 4B

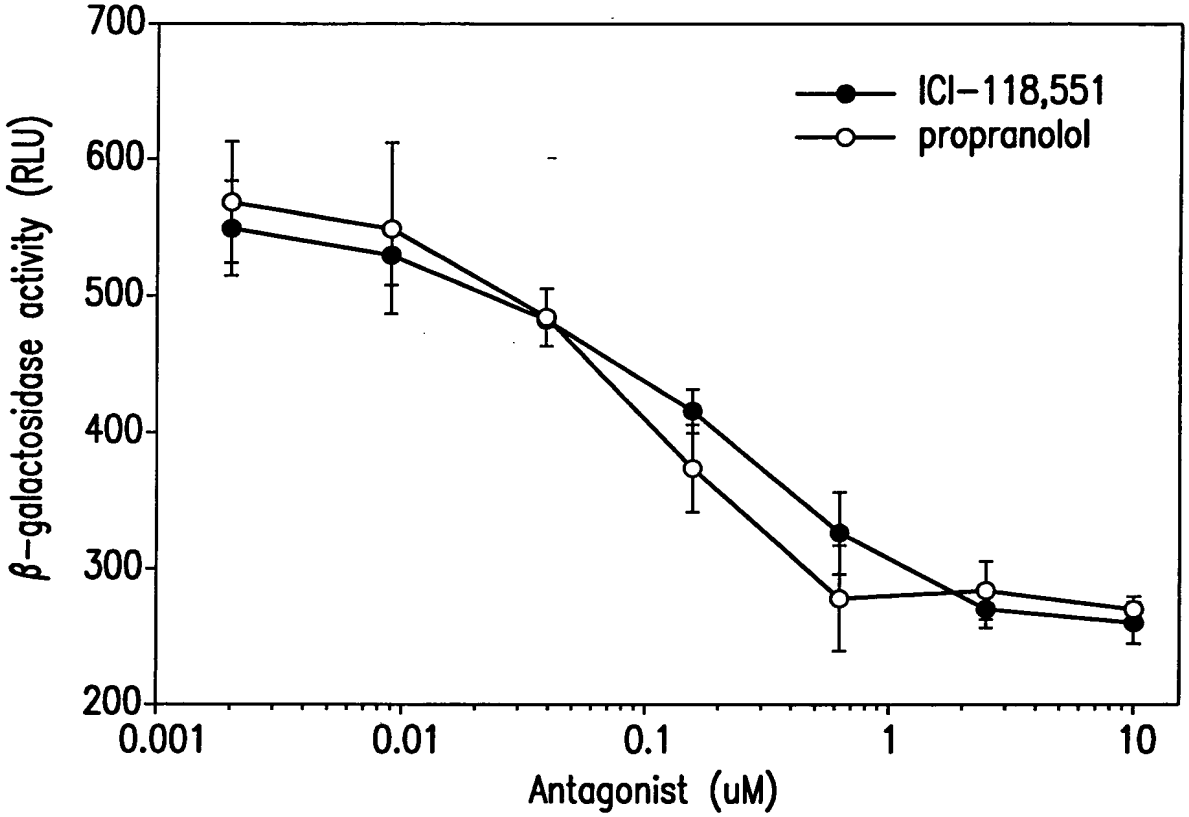

FIG. 5A

Antagonist Inhibition of β-galactosidase Activity in C2 Cells
Coexpressing β2AR-βgalΔα and βArrestin1-βgalΔω Fusion Proteins

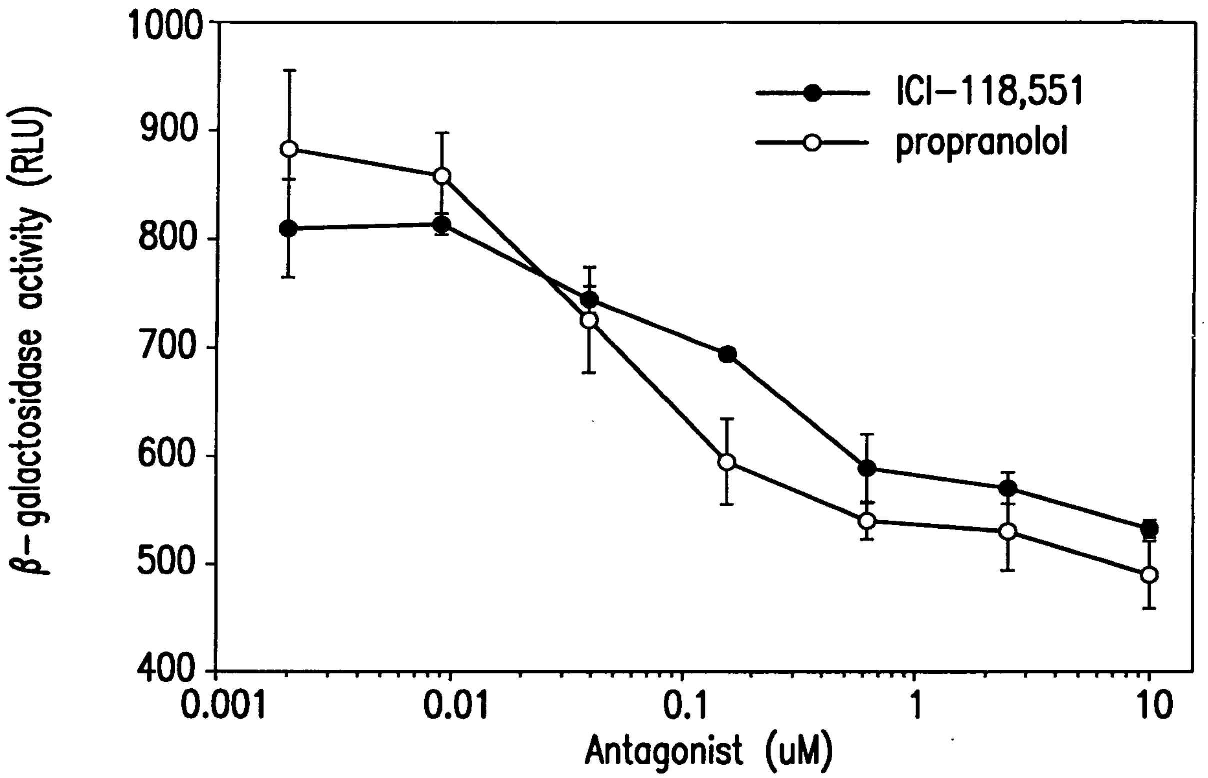

FIG. 5B

Agonist Stimulated cAMP Response in Clones or Pools of C2 Cells
Coexpressing A2aR–βgal $\Delta\alpha$ and
βArrestin1– βgal $\Delta\omega$ Fusion Proteins

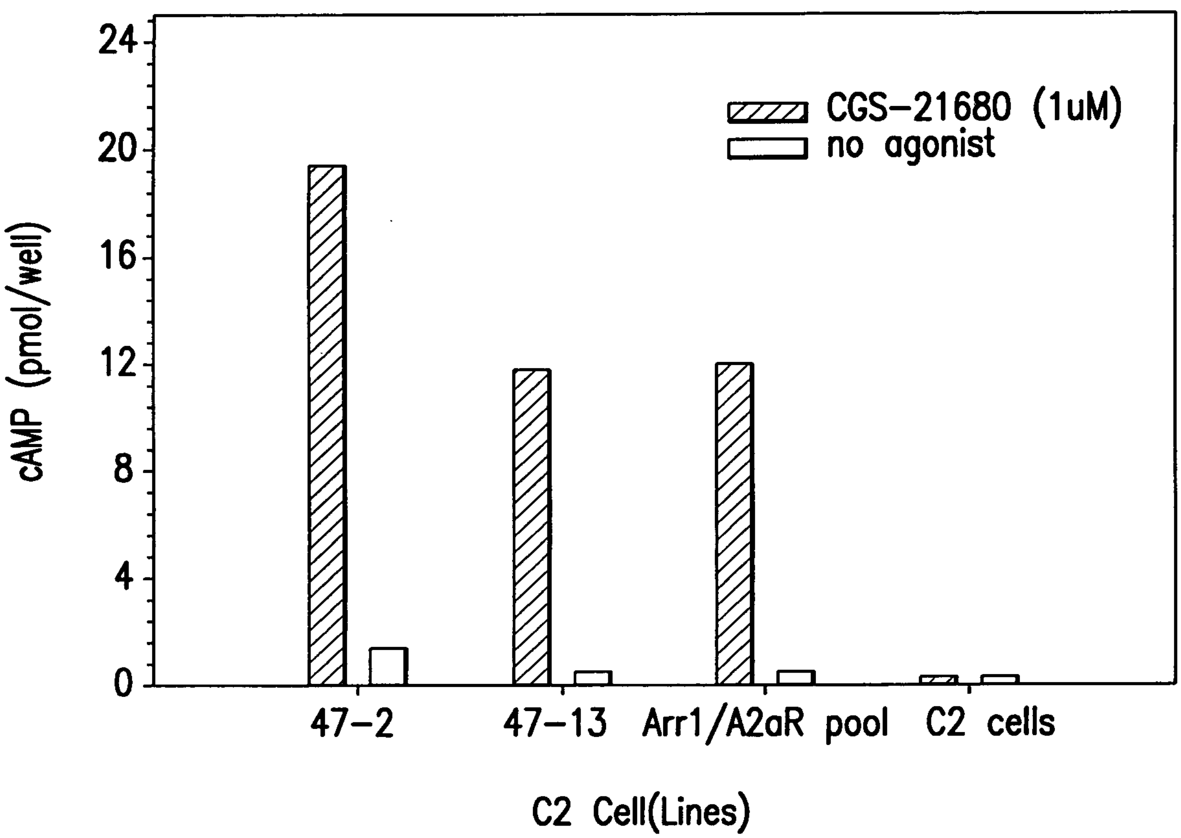

FIG.6

Agonist Stimulated cAMP Response in Clones or Pools of C2 Cells Expressing D1–βgal Δα and βArrestin2–βgal Δω Fusion Proteins

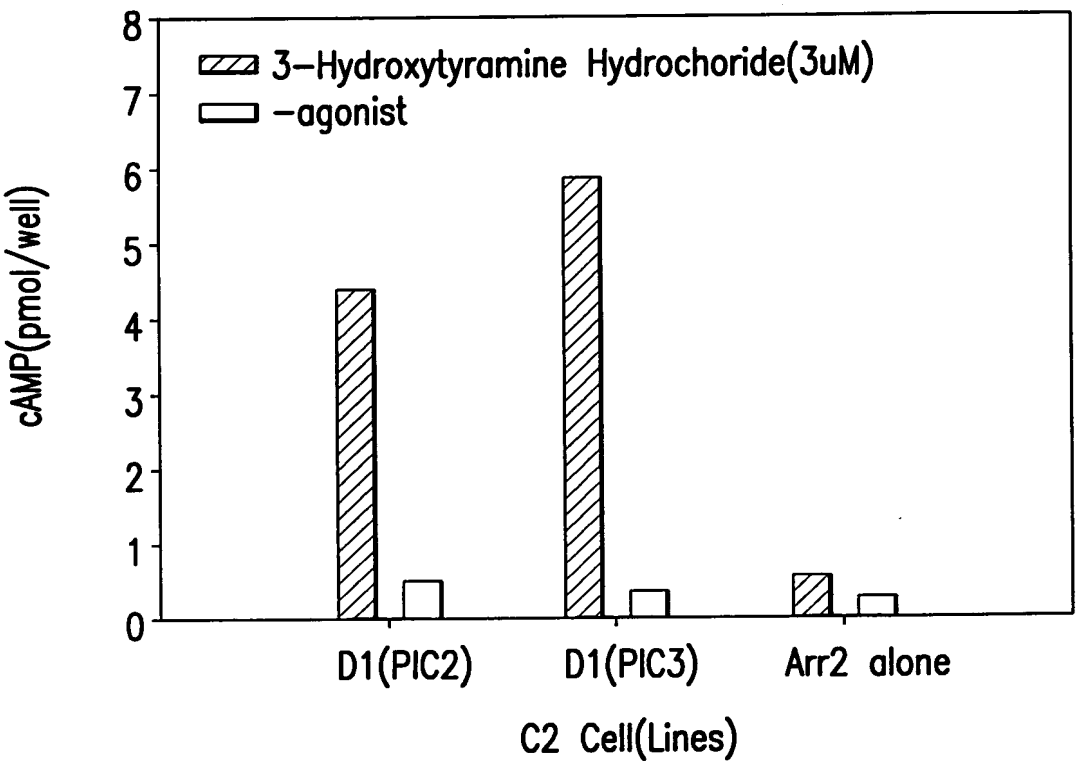

FIG. 7

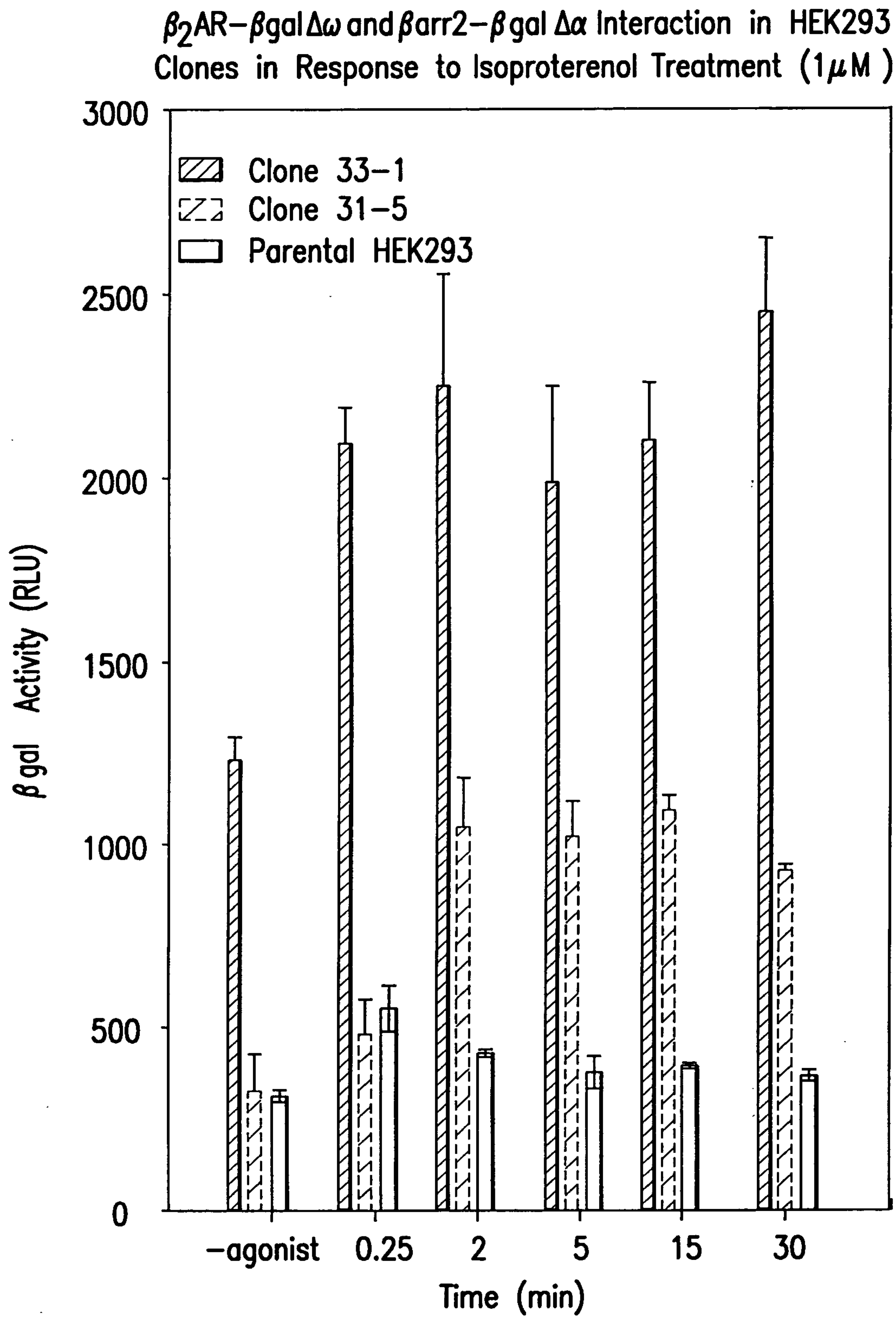

FIG. 8A

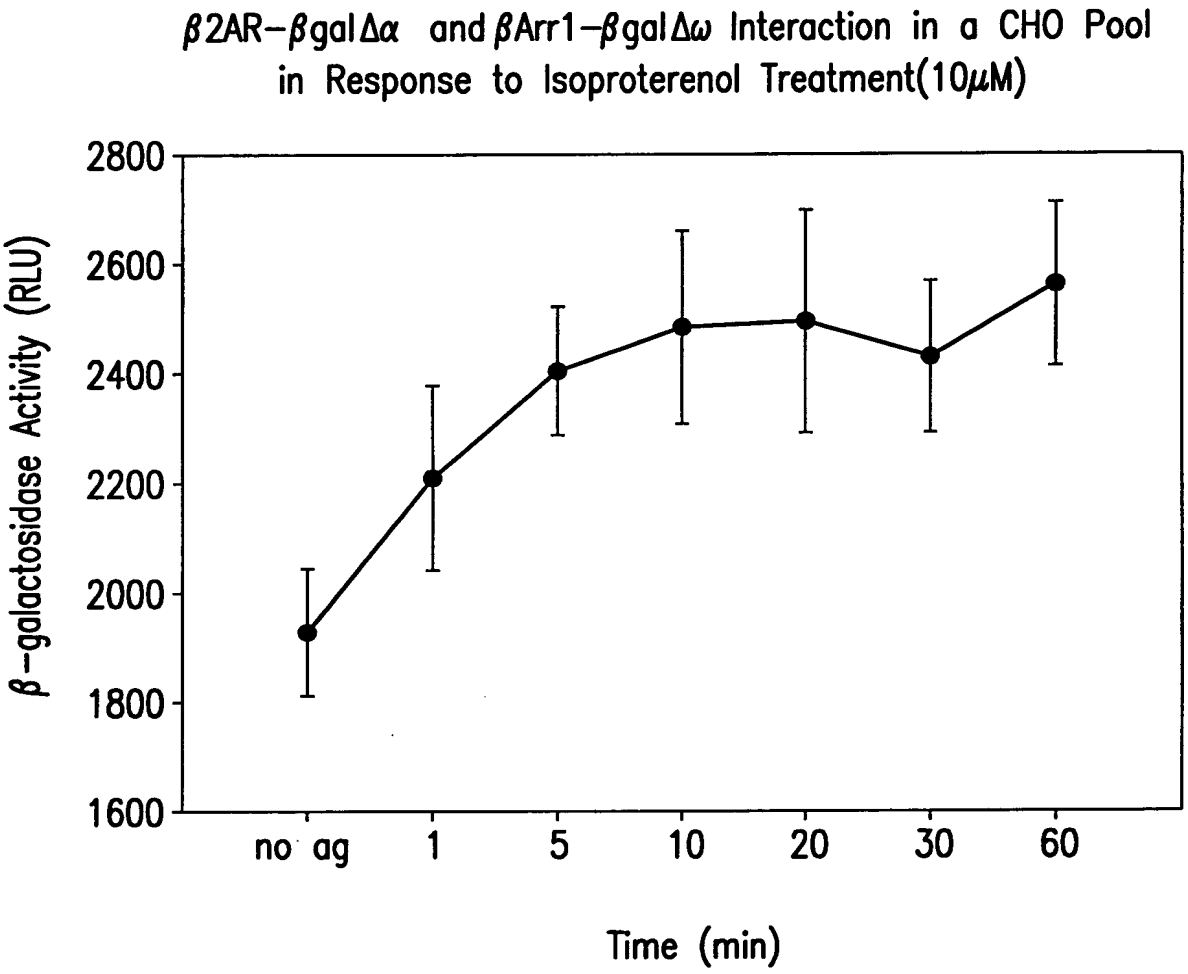

FIG. 8B

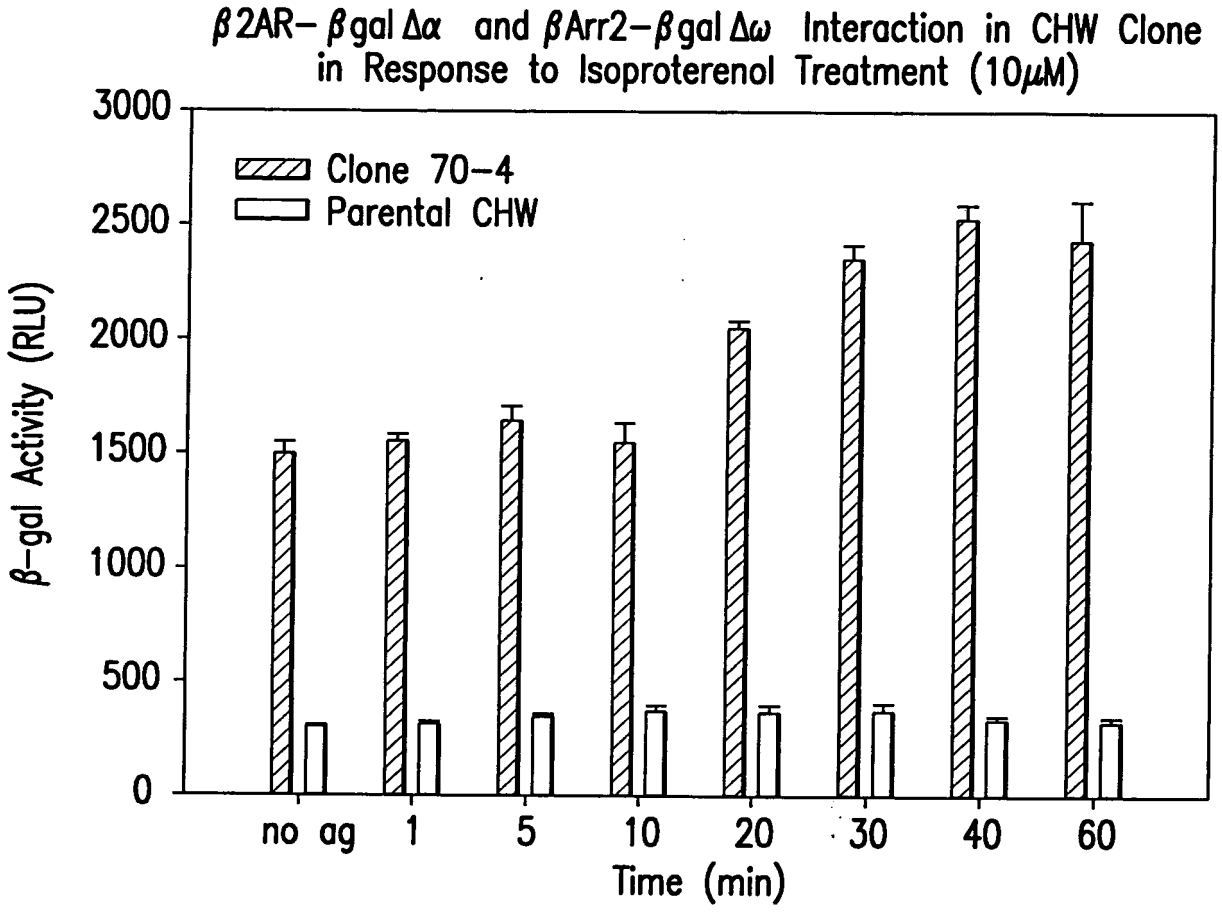
β2AR–βgal Δα and βArr2–βgal Δω Interaction in CHW Clone in Response to Isoproterenol Treatment (10μM)
Clone 70–4
Parental CHW
β-gal Activity (RLU)
3000
2500
2000
1500
1000
500
0
no ag
1
5
10
20
30
40
60
Time (min)

FIG. 8C

β-galactosidase Complementation as a Measurement for Adrenergic Receptor Homodimerization in HEK 293 Cells Coexpressing β2AR-βgal Δα and β2AR-βgal Δω.

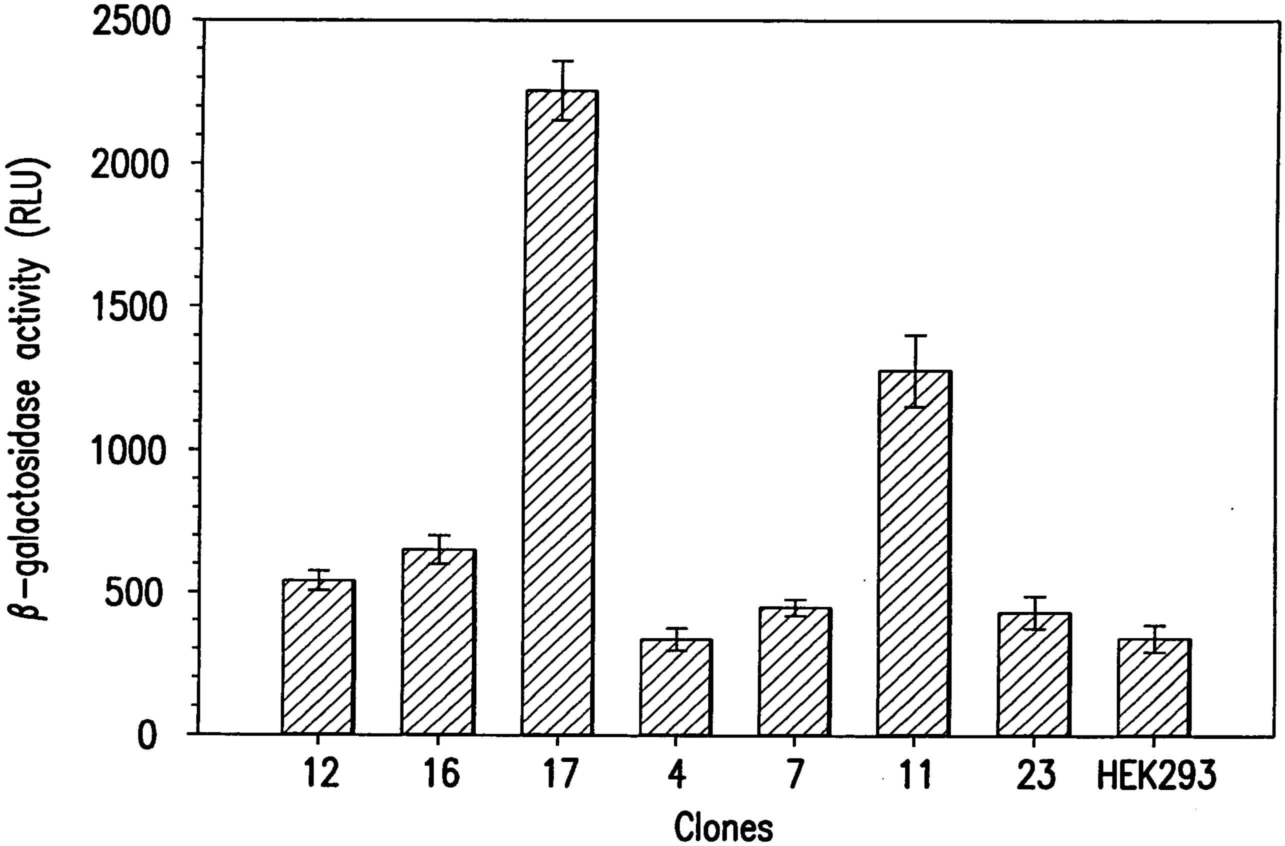

FIG. 9A

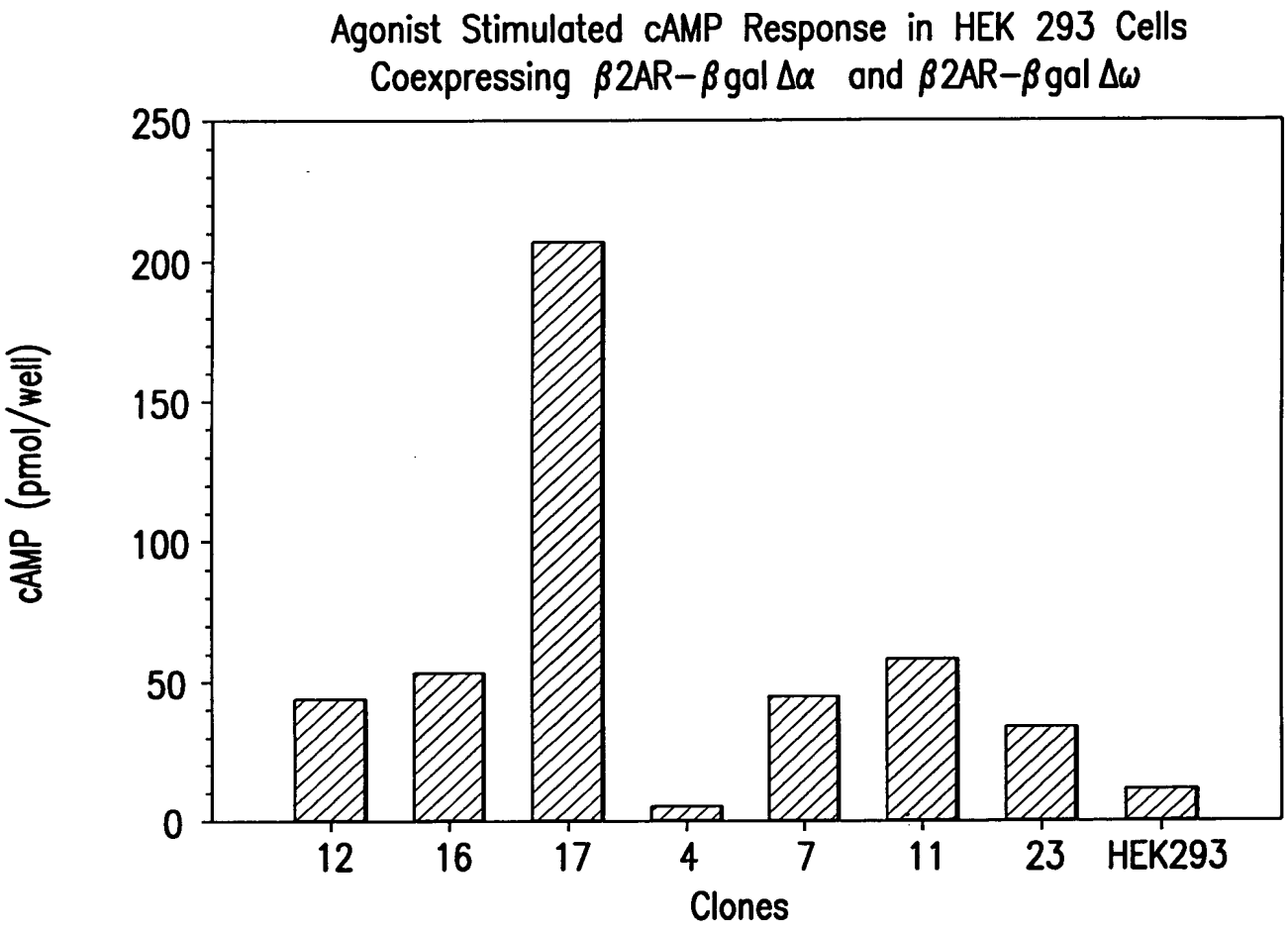
Agonist Stimulated cAMP Response in HEK 293 Cells
Coexpressing β2AR–β gal Δα and β2AR–β gal Δω
cAMP (pmol/well)
250
200
150
100
50
0
12
16
17
4
7
11
23
HEK293
Clones

FIG. 9B

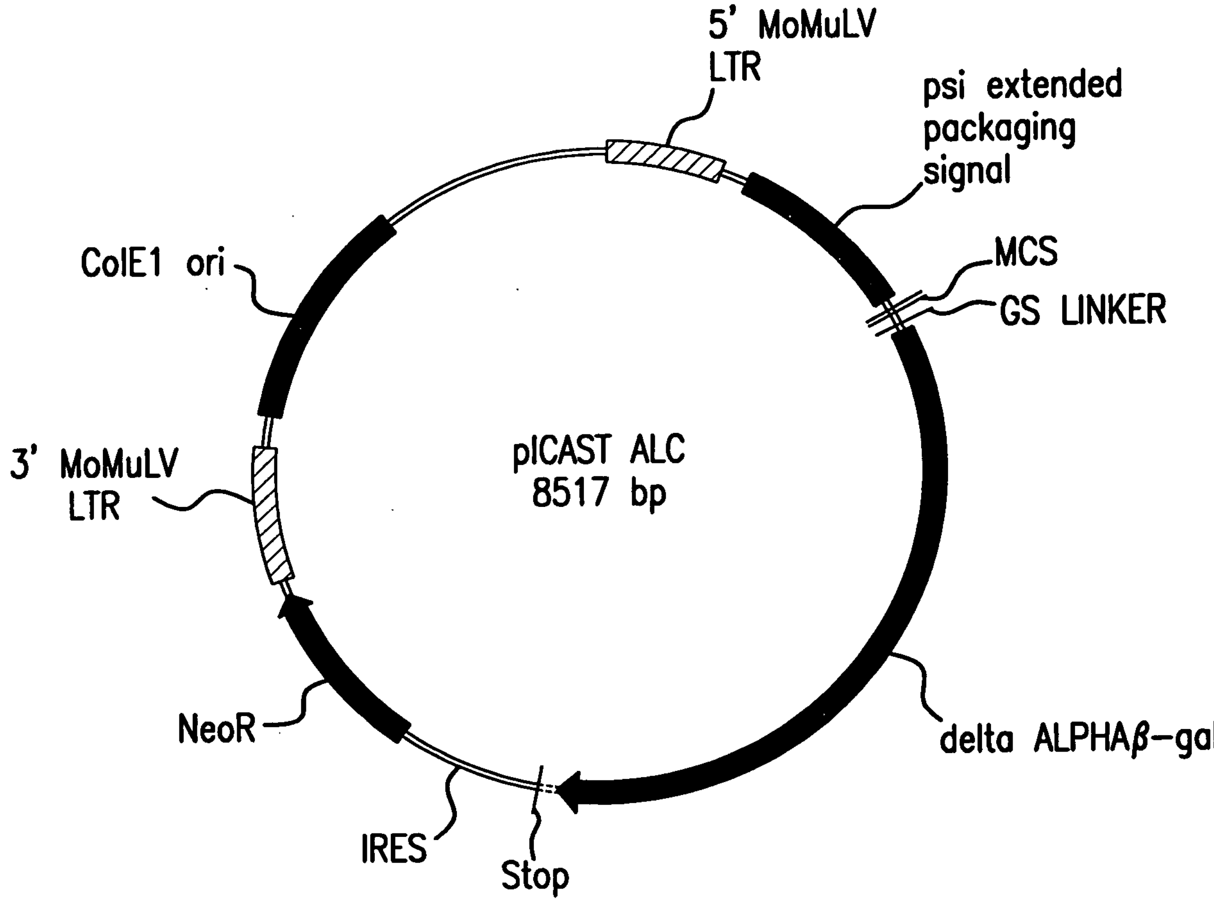

FIG.10A

pICAST ALC

```
   1  CTGCAGCCTG AATATGGGCC AAACAGGATA TCTGTGGTAA GCAGTTCCTG
      GACGTCGGAC TTATACCCGG TTTGTCCTAT AGACACCATT CGTCAAGGAC

  51  CCCCGGCTCA GGGCCAAGAA CAGATGGAAC AGCTGAATAT GGGCCAAACA
      GGGGCCGAGT CCCGGTTCTT GTCTACCTTG TCGACTTATA CCCGGTTTGT

 101  GGATATCTGT GGTAAGCAGT TCCTGCCCCG GCTCAGGGCC AAGAACAGAT
      CCTATAGACA CCATTCGTCA AGGACGGGGC CGAGTCCCGG TTCTTGTCTA

 151  GGTCCCCAGA TGCGGTCCAG CCCTCAGCAG TTTCTAGAGA ACCATCAGAT
      CCAGGGGTCT ACGCCAGGTC GGGAGTCGTC AAAGATCTCT TGGTAGTCTA

 201  GTTTCCAGGG TGCCCCAAGG ACCTGAAATG ACCCTGTGCC TTATTTGAAC
      CAAAGGTCCC ACGGGGTTCC TGGACTTTAC TGGGACACGG AATAAACTTG

 251  TAACCAATCA GTTCGCTTCT CGCTTCTGTT CGCGCGCTTC TGCTCCCCGA
      ATTGGTTAGT CAAGCGAAGA GCGAAGACAA GCGCGCGAAG ACGAGGGGCT

 301  GCTCAATAAA AGAGCCCACA ACCCCTCACT CGGGGCGCCA GTCCTCCGAT
      CGAGTTATTT TCTCGGGTGT TGGGGAGTGA GCCCCGCGGT CAGGAGGCTA

 351  TGACTGAGTC GCCCGGGTAC CCGTGTATCC AATAAACCCT CTTGCAGTTG
      ACTGACTCAG CGGGCCCATG GGCACATAGG TTATTTGGGA GAACGTCAAC

 401  CATCCGACTT GTGGTCTCGC TGTTCCTTGG GAGGGTCTCC TCTGAGTGAT
      GTAGGCTGAA CACCAGAGCG ACAAGGAACC CTCCCAGAGG AGACTCACTA

 451  TGACTACCCG TCAGCGGGGG TCTTTCATTT GGGGGCTCGT CCGGGATCGG
      ACTGATGGGC AGTCGCCCCC AGAAAGTAAA CCCCCGAGCA GGCCCTAGCC

 501  GAGACCCCTG CCCAGGGACC ACCGACCCAC CACCGGGAGG CAAGCTGGCC
      CTCTGGGGAC GGGTCCCTGG TGGCTGGGTG GTGGCCCTCC GTTCGACCGG

 551  AGCAACTTAT CTGTGTCTGT CCGATTGTCT AGTGTCTATG ACTGATTTTA
      TCGTTGAATA GACACAGACA GGCTAACAGA TCACAGATAC TGACTAAAAT

 601  TGCGCCTGCG TCGGTACTAG TTAGCTAACT AGCTCTGTAT CTGGCGGACC
      ACGCGGACGC AGCCATGATC AATCGATTGA TCGAGACATA GACCGCCTGG
```


FIG.10B-1

```
651   CGTGGTGGAA CTGACGAGTT CTGAACACCC GGCCGCAACC CTGGGAGACG
      GCACCACCTT GACTGCTCAA GACTTGTGGG CCGGCGTTGG GACCCTCTGC

701   TCCCAGGGAC TTTGGGGGCC GTTTTTGTGG CCCGACCTGA GGAAGGGAGT
      AGGGTCCCTG AAACCCCCGG CAAAAACACC GGGCTGGACT CCTTCCCTCA

751   CGATGTGGAA TCCGACCCCG TCAGGATATG TGGTTCTGGT AGGAGACGAG
      GCTACACCTT AGGCTGGGGC AGTCCTATAC ACCAAGACCA TCCTCTGCTC

801   AACCTAAAAC AGTTCCCGCC TCCGTCTGAA TTTTTGCTTT CGGTTTGGAA
      TTGGATTTTG TCAAGGGCGG AGGCAGACTT AAAAACGAAA GCCAAACCTT

851   CCGAAGCCGC GCGTCTTGTC TGCTGCAGCA TCGTTCTGTG TTGTCTCTGT
      GGCTTCGGCG CGCAGAACAG ACGACGTCGT AGCAAGACAC AACAGAGACA

901   CTGACTGTGT TTCTGTATTT GTCTGAAAAT TAGGGCCAGA CTGTTACCAC
      GACTGACACA AAGACATAAA CAGACTTTTA ATCCCGGTCT GACAATGGTG

951   TCCCTTAAGT TTGACCTTAG GTAACTGGAA AGATGTCGAG CGGCTCGCTC
      AGGGAATTCA AACTGGAATC CATTGACCTT TCTACAGCTC GCCGAGCGAG

1001  ACAACCAGTC GGTAGATGTC AAGAAGAGAC GTTGGGTTAC CTTCTGCTCT
      TGTTGGTCAG CCATCTACAG TTCTTCTCTG CAACCCAATG GAAGACGAGA

1051  GCAGAATGGC CAACCTTTAA CGTCGGATGG CCGCGAGACG GCACCTTTAA
      CGTCTTACCG GTTGGAAATT GCAGCCTACC GGCGCTCTGC CGTGGAAATT

1101  CCGAGACCTC ATCACCCAGG TTAAGATCAA GGTCTTTTCA CCTGGCCCGC
      GGCTCTGGAG TAGTGGGTCC AATTCTAGTT CCAGAAAAGT GGACCGGGCG

1151  ATGGACACCC AGACCAGGTC CCCTACATCG TGACCTGGGA AGCCTTGGCT
      TACCTGTGGG TCTGGTCCAG GGGATGTAGC ACTGGACCCT TCGGAACCGA

1201  TTTGACCCCC CTCCCTGGGT CAAGCCCTTT GTACACCCTA AGCCTCCGCC
      AAACTGGGGG GAGGGACCCA GTTCGGGAAA CATGTGGGAT TCGGAGGCGG

1251  TCCTCTTCCT CCATCCGCCC CGTCTCTCCC CCTTGAACCT CCTCGTTCGA
      AGGAGAAGGA GGTAGGCGGG GCAGAGAGGG GGAACTTGGA GGAGCAAGCT
```


FIG.10B-2

pICAST ALC

1301 CCCCGCCTCG ATCCTCCCTT TATCCAGCCC TCACTCCTTC TCTAGGCGCC
GGGGCGGAGC TAGGAGGGAA ATAGGTCGGG AGTGAGGAAG AGATCCGCGG

1351 GGCCGCTCTA GCCCATTAAT ACGACTCACT ATAGGGCGAT TCGAATCAGG
CCGGCGAGAT CGGGTAATTA TGCTGAGTGA TATCCCGCTA AGCTTAGTCC

1401 CCTTGGCGCG CCGGATCCTT AATTAAGCGC AATTGGGAGG TGGCGGTAGC
GGAACCGCGC GGCCTAGGAA TTAATTCGCG TTAACCCTCC ACCGCCATCG

+2 M G V I T D S L A V V A R T D
]---
1451 CTCGAGATGG GCGTGATTAC GGATTCACTG GCCGTCGTGG CCCGCACCGA
GAGCTCTACC CGCACTAATG CCTAAGTGAC CGGCAGCACC GGGCGTGGCT

+2 R P S Q Q L R S L N G E W R F A

1501 TCGCCCTTCC CAACAGTTAC GCAGCCTGAA TGGCGAATGG CGCTTTGCCT
AGCGGGAAGG GTTGTCAATG CGTCGGACTT ACCGCTTACC GCGAAACGGA

+2 W F P A P E A V P E S W L E C D L

1551 GGTTTCCGGC ACCAGAAGCG GTGCCGGAAA GCTGGCTGGA GTGCGATCTT
CCAAAGGCCG TGGTCTTCGC CACGGCCTTT CGACCGACCT CACGCTAGAA

+2 P E A D T V V V P S N W Q M H G Y

1601 CCTGAGGCCG ATACTGTCGT CGTCCCCTCA AACTGGCAGA TGCACGGTTA
GGACTCCGGC TATGACAGCA GCAGGGGAGT TTGACCGTCT ACGTGCCAAT

+2 D A P I Y T N V T Y P I T V N P

1651 CGATGCGCCC ATCTACACCA ACGTGACCTA TCCCATTACG GTCAATCCGC
GCTACGCGGG TAGATGTGGT TGCACTGGAT AGGGTAATGC CAGTTAGGCG

+2 P F V P T E N P T G C Y S L T F N

1701 CGTTTGTTCC CACGGAGAAT CCGACGGGTT GTTACTCGCT CACATTTAAT
GCAAACAAGG GTGCCTCTTA GGCTGCCCAA CAATGAGCGA GTGTAAATTA

FIG.10B-3

```
+2      V  D  E  S  W  L  Q  E  G  Q  T  R  I  I  F  D  G
        ----------------------------------------------------
1751    GTTGATGAAA GCTGGCTACA GGAAGGCCAG ACGCGAATTA TTTTTGATGG
        CAACTACTTT CGACCGATGT CCTTCCGGTC TGCGCTTAAT AAAAACTACC

+2        V  N  S  A  F  H  L  W  C  N  G  R  W  V  G  Y
          ----------------------------------------------------
1801    CGTTAACTCG GCGTTTCATC TGTGGTGCAA CGGGCGCTGG GTCGGTTACG
        GCAATTGAGC CGCAAAGTAG ACACCACGTT GCCCGCGACC CAGCCAATGC

+2      G  Q  D  S  R  L  P  S  E  F  D  L  S  A  F  L  R
        ----------------------------------------------------
1851    GCCAGGACAG TCGTTTGCCG TCTGAATTTG ACCTGAGCGC ATTTTTACGC
        CGGTCCTGTC AGCAAACGGC AGACTTAAAC TGGACTCGCG TAAAAATGCG

+2      A  G  E  N  R  L  A  V  M  V  L  R  W  S  D  G  S
        ----------------------------------------------------
1901    GCCGGAGAAA ACCGCCTCGC GGTGATGGTG CTGCGCTGGA GTGACGGCAG
        CGGCCTCTTT TGGCGGAGCG CCACTACCAC GACGCGACCT CACTGCCGTC

+2        Y  L  E  D  Q  D  M  W  R  M  S  G  I  F  R  D
          ----------------------------------------------------
1951    TTATCTGGAA GATCAGGATA TGTGGCGGAT GAGCGGCATT TTCCGTGACG
        AATAGACCTT CTAGTCCTAT ACACCGCCTA CTCGCCGTAA AAGGCACTGC

+2      V  S  L  L  H  K  P  T  T  Q  I  S  D  F  H  V  A
        ----------------------------------------------------
2001    TCTCGTTGCT GCATAAACCG ACTACACAAA TCAGCGATTT CCATGTTGCC
        AGAGCAACGA CGTATTTGGC TGATGTGTTT AGTCGCTAAA GGTACAACGG

+2      T  R  F  N  D  D  F  S  R  A  V  L  E  A  E  V  Q
        ----------------------------------------------------
2051    ACTCGCTTTA ATGATGATTT CAGCCGCGCT GTACTGGAGG CTGAAGTTCA
        TGAGCGAAAT TACTACTAAA GTCGGCGCGA CATGACCTCC GACTTCAAGT
```

FIG.10B-4

pICAST ALC

```
+2       M  C  G   E  L  R  D   Y  L  R   V  T  V   S  L  W
        ---------------------------------------------------
2101    GATGTGCGGC GAGTTGCGTG ACTACCTACG GGTAACAGTT TCTTTATGGC
        CTACACGCCG CTCAACGCAC TGATGGATGC CCATTGTCAA AGAAATACCG

+2      Q  G  E  T   Q  V  A   S  G  T  A   P  F  G   G  E  I
        ---------------------------------------------------
2151    AGGGTGAAAC GCAGGTCGCC AGCGGCACCG CGCCTTTCGG CGGTGAAATT
        TCCCACTTTG CGTCCAGCGG TCGCCGTGGC GCGGAAAGCC GCCACTTTAA

+2       I  D  E  R   G  G  Y   A  D  R   V  T  L  R   L  N  V
        ---------------------------------------------------
2201    ATCGATGAGC GTGGTGGTTA TGCCGATCGC GTCACACTAC GTCTGAACGT
        TAGCTACTCG CACCACCAAT ACGGCTAGCG CAGTGTGATG CAGACTTGCA

+2       E  N  P   K  L  W  S   A  E  I   P  N  L   Y  R  A
        ---------------------------------------------------
2251    CGAAAACCCG AAACTGTGGA GCGCCGAAAT CCCGAATCTC TATCGTGCGG
        GCTTTTGGGC TTTGACACCT CGCGGCTTTA GGGCTTAGAG ATAGCACGCC

+2      V  V  E  L   H  T  A   D  G  T  L   I  E  A   E  A  C
        ---------------------------------------------------
2301    TGGTTGAACT GCACACCGCC GACGGCACGC TGATTGAAGC AGAAGCCTGC
        ACCAACTTGA CGTGTGGCGG CTGCCGTGCG ACTAACTTCG TCTTCGGACG

+2       D  V  G  F   R  E  V   R  I  E   N  G  L  L   L  L  N
        ---------------------------------------------------
2351    GATGTCGGTT TCCGCGAGGT GCGGATTGAA AATGGTCTGC TGCTGCTGAA
        CTACAGCCAA AGGCGCTCCA CGCCTAACTT TTACCAGACG ACGACGACTT

+2       G  K  P   L  L  I  R   G  V  N   R  H  E   H  H  P
        ---------------------------------------------------
2401    CGGCAAGCCG TTGCTGATTC GAGGCGTTAA CCGTCACGAG CATCATCCTC
        GCCGTTCGGC AACGACTAAG CTCCGCAATT GGCAGTGCTC GTAGTAGGAG
```

FIG.10B-5

```
+2      L  H  G  Q   V  M  D   E  Q  T  M   V  Q  D   I  L  L
        ------------------------------------------------------
2451    TGCATGGTCA GGTCATGGAT GAGCAGACGA TGGTGCAGGA TATCCTGCTG
        ACGTACCAGT CCAGTACCTA CTCGTCTGCT ACCACGTCCT ATAGGACGAC

+2       M  K  Q  N   N  F  N   A  V  R   C  S  H  Y   P  N  H
        ------------------------------------------------------
2501    ATGAAGCAGA ACAACTTTAA CGCCGTGCGC TGTTCGCATT ATCCGAACCA
        TACTTCGTCT TGTTGAAATT GCGGCACGCG ACAAGCGTAA TAGGCTTGGT

+2        P  L  W   Y  T  L  C   D  R  Y   G  L  Y   V  V  D
        ------------------------------------------------------
2551    TCCGCTGTGG TACACGCTGT GCGACCGCTA CGGCCTGTAT GTGGTGGATG
        AGGCGACACC ATGTGCGACA CGCTGGCGAT GCCGGACATA CACCACCTAC

+2      E  A  N  I   E  T  H   G  M  V  P   M  N  R   L  T  D
        ------------------------------------------------------
2601    AAGCCAATAT TGAAACCCAC GGCATGGTGC CAATGAATCG TCTGACCGAT
        TTCGGTTATA ACTTTGGGTG CCGTACCACG GTTACTTAGC AGACTGGCTA

+2       D  P  R  W   L  P  A   M  S  E   R  V  T   R  M  V  Q
        ------------------------------------------------------
2651    GATCCGCGCT GGCTACCGGC GATGAGCGAA CGCGTAACGC GAATGGTGCA
        CTAGGCGCGA CCGATGGCCG CTACTCGCTT GCGCATTGCG CTTACCACGT

+2        R  D  R   N  H  P  S   V  I  I   W  S  L   G  N  E
        ------------------------------------------------------
2701    GCGCGATCGT AATCACCCGA GTGTGATCAT CTGGTCGCTG GGGAATGAAT
        CGCGCTAGCA TTAGTGGGCT CACACTAGTA GACCAGCGAC CCCTTACTTA

+2      S  G  H  G   A  N  H   D  A  L  Y   R  W  I   K  S  V
        ------------------------------------------------------
2751    CAGGCCACGG CGCTAATCAC GACGCGCTGT ATCGCTGGAT CAAATCTGTC
        GTCCGGTGCC GCGATTAGTG CTGCGCGACA TAGCGACCTA GTTTAGACAG
```

FIG.10B-6

pICAST ALC

```
+2      D  P  S  R   P  V  Q   Y  E  G   G  G  A  D   T  T  A
        --------------------------------------------------
2801    GATCCTTCCC GCCCGGTGCA GTATGAAGGC GGCGGAGCCG ACACCACGGC
        CTAGGAAGGG CGGGCCACGT CATACTTCCG CCGCCTCGGC TGTGGTGCCG

+2       T  D  I   I  C  P  M   Y  A  R   V  D  E   D  Q  P
        --------------------------------------------------
2851    CACCGATATT ATTTGCCCGA TGTACGCGCG CGTGGATGAA GACCAGCCCT
        GTGGCTATAA TAAACGGGCT ACATGCGCGC GCACCTACTT CTGGTCGGGA

+2      F  P  A  V   P  K  W   S  I  K  K   W  L  S   L  P  G
        --------------------------------------------------
2901    TCCCGGCTGT GCCGAAATGG TCCATCAAAA AATGGCTTTC GCTACCTGGA
        AGGGCCGACA CGGCTTTACC AGGTAGTTTT TTACCGAAAG CGATGGACCT

+2       E  T  R  P   L  I  L   C  E  Y   A  H  A  M   G  N  S
        --------------------------------------------------
2951    GAGACGCGCC CGCTGATCCT TTGCGAATAC GCCCACGCGA TGGGTAACAG
        CTCTGCGCGG GCGACTAGGA AACGCTTATG CGGGTGCGCT ACCCATTGTC

+2       L  G  G   F  A  K  Y   W  Q  A   F  R  Q   Y  P  R
        --------------------------------------------------
3001    TCTTGGCGGT TTCGCTAAAT ACTGGCAGGC GTTTCGTCAG TATCCCCGTT
        AGAACCGCCA AAGCGATTTA TGACCGTCCG CAAAGCAGTC ATAGGGGCAA

+2      L  Q  G  G   F  V  W   D  W  V  D   Q  S  L   I  K  Y
        --------------------------------------------------
3051    TACAGGGCGG CTTCGTCTGG GACTGGGTGG ATCAGTCGCT GATTAAATAT
        ATGTCCCGCC GAAGCAGACC CTGACCCACC TAGTCAGCGA CTAATTTATA

+2       D  E  N  G   N  P  W   S  A  Y   G  G  D  F   G  D  T
        --------------------------------------------------
3101    GATGAAAACG GCAACCCGTG GTCGGCTTAC GGCGGTGATT TTGGCGATAC
        CTACTTTTGC CGTTGGGCAC CAGCCGAATG CCGCCACTAA AACCGCTATG
```

FIG.10B-7

pICAST ALC

```
+2        P  N  D  R  Q  F  C  M  N  G  L  V  F  A  D  R
          ------------------------------------------------
3151      GCCGAACGAT CGCCAGTTCT GTATGAACGG TCTGGTCTTT GCCGACCGCA
          CGGCTTGCTA GCGGTCAAGA CATACTTGCC AGACCAGAAA CGGCTGGCGT

+2        T  P  H  P  A  L  T  E  A  K  H  Q  Q  Q  F  F  Q
          ------------------------------------------------
3201      CGCCGCATCC AGCGCTGACG GAAGCAAAAC ACCAGCAGCA GTTTTTCCAG
          GCGGCGTAGG TCGCGACTGC CTTCGTTTTG TGGTCGTCGT CAAAAAGGTC

+2        F  R  L  S  G  Q  T  I  E  V  T  S  E  Y  L  F  R
          ------------------------------------------------
3251      TTCCGTTTAT CCGGGCAAAC CATCGAAGTG ACCAGCGAAT ACCTGTTCCG
          AAGGCAAATA GGCCCGTTTG GTAGCTTCAC TGGTCGCTTA TGGACAAGGC

+2        H  S  D  N  E  L  L  H  W  M  V  A  L  D  G  K
          ------------------------------------------------
3301      TCATAGCGAT AACGAGCTCC TGCACTGGAT GGTGGCGCTG GATGGTAAGC
          AGTATCGCTA TTGCTCGAGG ACGTGACCTA CCACCGCGAC CTACCATTCG

+2        P  L  A  S  G  E  V  P  L  D  V  A  P  Q  G  K  Q
          ------------------------------------------------
3351      CGCTGGCAAG CGGTGAAGTG CCTCTGGATG TCGCTCCACA AGGTAAACAG
          GCGACCGTTC GCCACTTCAC GGAGACCTAC AGCGAGGTGT TCCATTTGTC

+2        L  I  E  L  P  E  L  P  Q  P  E  S  A  G  Q  L  W
          ------------------------------------------------
3401      TTGATTGAAC TGCCTGAACT ACCGCAGCCG GAGAGCGCCG GGCAACTCTG
          AACTAACTTG ACGGACTTGA TGGCGTCGGC CTCTCGCGGC CCGTTGAGAC

+2        L  T  V  R  V  V  Q  P  N  A  T  A  W  S  E  A
          ------------------------------------------------
3451      GCTCACAGTA CGCGTAGTGC AACCGAACGC GACCGCATGG TCAGAAGCCG
          CGAGTGTCAT GCGCATCACG TTGGCTTGCG CTGGCGTACC AGTCTTCGGC
```

FIG.10B-8

pICAST ALC

```
+2    G H I S  A W Q  Q W R L  A E N  L S V
      --------------------------------------------------
3501  GGCACATCAG CGCCTGGCAG CAGTGGCGTC TGGCGGAAAA CCTCAGTGTG
      CCGTGTAGTC GCGGACCGTC GTCACCGCAG ACCGCCTTTT GGAGTCACAC

+2     T L P A  A S H  A I P  H L T T  S E M
      --------------------------------------------------
3551  ACGCTCCCCG CCGCGTCCCA CGCCATCCCG CATCTGACCA CCAGCGAAAT
      TGCGAGGGGC GGCGCAGGGT GCGGTAGGGC GTAGACTGGT GGTCGCTTTA

+2     D F C  I E L G  N K R  W Q F  N R Q
      --------------------------------------------------
3601  GGATTTTTGC ATCGAGCTGG GTAATAAGCG TTGGCAATTT AACCGCCAGT
      CCTAAAAACG TAGCTCGACC CATTATTCGC AACCGTTAAA TTGGCGGTCA

+2    S G F L  S Q M  W I G D  K K Q  L L T
      --------------------------------------------------
3651  CAGGCTTTCT TTCACAGATG TGGATTGGCG ATAAAAAACA ACTGCTGACG
      GTCCGAAAGA AAGTGTCTAC ACCTAACCGC TATTTTTTGT TGACGACTGC

+2     P L R D  Q F T  R A P  L D N D  I G V
      --------------------------------------------------
3701  CCGCTGCGCG ATCAGTTCAC CCGTGCACCG CTGGATAACG ACATTGGCGT
      GGCGACGCGC TAGTCAAGTG GGCACGTGGC GACCTATTGC TGTAACCGCA

+2     S E A  T R I D  P N A  W V E  R W K
      --------------------------------------------------
3751  AAGTGAAGCG ACCCGCATTG ACCCTAACGC CTGGGTCGAA CGCTGGAAGG
      TTCACTTCGC TGGGCGTAAC TGGGATTGCG GACCCAGCTT GCGACCTTCC

+2    A A G H  Y Q A  E A A L  L Q C  T A D
      --------------------------------------------------
3801  CGGCGGGCCA TTACCAGGCC GAAGCAGCGT TGTTGCAGTG CACGGCAGAT
      GCCGCCCGGT AATGGTCCGG CTTCGTCGCA ACAACGTCAC GTGCCGTCTA
```

FIG.10B-9

```
+2      T  L  A  D  A  V  L  I  T  T  A  H  A  W  Q  H  Q
        ------------------------------------------------

3851    ACACTTGCTG ATGCGGTGCT GATTACGACC GCTCACGCGT GGCAGCATCA
        TGTGAACGAC TACGCCACGA CTAATGCTGG CGAGTGCGCA CCGTCGTAGT

+2       G  K  T  L  F  I  S  R  K  T  Y  R  I  D  G  S
        ------------------------------------------------

3901    GGGGAAAACC TTATTTATCA GCCGGAAAAC CTACCGGATT GATGGTAGTG
        CCCCTTTTGG AATAAATAGT CGGCCTTTTG GATGGCCTAA CTACCATCAC

+2      G  Q  M  A  I  T  V  D  V  E  V  A  S  D  T  P  H
        ------------------------------------------------

3951    GTCAAATGGC GATTACCGTT GATGTTGAAG TGGCGAGCGA TACACCGCAT
        CAGTTTACCG CTAATGGCAA CTACAACTTC ACCGCTCGCT ATGTGGCGTA

+2      P  A  R  I  G  L  N  C  Q  L  A  Q  V  A  E  R  V
        ------------------------------------------------

4001    CCGGCGCGGA TTGGCCTGAA CTGCCAGCTG GCGCAGGTAG CAGAGCGGGT
        GGCCGCGCCT AACCGGACTT GACGGTCGAC CGCGTCCATC GTCTCGCCCA

+2       N  W  L  G  L  G  P  Q  E  N  Y  P  D  R  L  T
        ------------------------------------------------

4051    AAACTGGCTC GGATTAGGGC CGCAAGAAAA CTATCCCGAC CGCCTTACTG
        TTTGACCGAG CCTAATCCCG GCGTTCTTTT GATAGGGCTG GCGGAATGAC

+2      A  A  C  F  D  R  W  D  L  P  L  S  D  M  Y  T  P
        ------------------------------------------------

4101    CCGCCTGTTT TGACCGCTGG GATCTGCCAT TGTCAGACAT GTATACCCCG
        GGCGGACAAA ACTGGCGACC CTAGACGGTA ACAGTCTGTA CATATGGGGC

+2      T  V  F  P  S  E  N  G  L  R  C  G  T  R  E  L  N
        ------------------------------------------------

4151    TACGTCTTCC CGAGCGAAAA CGGTCTGCGC TGCGGGACGC GCGAATTGAA
        ATGCAGAAGG GCTCGCTTTT GCCAGACGCG ACGCCCTGCG CGCTTAACTT
```

FIG.10B-10

pICAST ALC

```
+2        Y  G  P   H  Q  W  R   G  D  F   Q  F  N   I  S  R
          ---------------------------------------------------
4201      TTATGGCCCA CACCAGTGGC GCGGCGACTT CCAGTTCAAC ATCAGCCGCT
          AATACCGGGT GTGGTCACCG CGCCGCTGAA GGTCAAGTTG TAGTCGGCGA

+2        Y  S  Q  Q   Q  L  M   E  T  S  H   R  H  L   L  H  A
          ---------------------------------------------------
4251      ACAGTCAACA GCAACTGATG GAAACCAGCC ATCGCCATCT GCTGCACGCG
          TGTCAGTTGT CGTTGACTAC CTTTGGTCGG TAGCGGTAGA CGACGTGCGC

+2        E  E  G  T   W  L  N   I  D  G   F  H  M  G   I  G  G
          ---------------------------------------------------
4301      GAAGAAGGCA CATGGCTGAA TATCGACGGT TTCCATATGG GGATTGGTGG
          CTTCTTCCGT GTACCGACTT ATAGCTGGCA AAGGTATACC CCTAACCACC

+2        D  D  S   W  S  P  S   V  S  A   E  F  Q   L  S  A
          ---------------------------------------------------
4351      CGACGACTCC TGGAGCCCGT CAGTATCGGC GGAATTCCAG CTGAGCGCCG
          GCTGCTGAGG ACCTCGGGCA GTCATAGCCG CCTTAAGGTC GACTCGCGGC

+2        G  R  Y  H   Y  Q  L   V  W  C  Q   K  R  S   D  Y  K
          ---------------------------------------------------
4401      GTCGCTACCA TTACCAGTTG GTCTGGTGTC AAAAAAGATC TGACTATAAA
          CAGCGATGGT AATGGTCAAC CAGACCACAG TTTTTTCTAG ACTGATATTT

+2        D  E  D  L   D  H  H   H  H  H   H  R
          ------------------------------------->
4451      GATGAGGACC TCGACCATCA TCATCATCAT CACCGGTAAT AATAGGTAGA
          CTACTCCTGG AGCTGGTAGT AGTAGTAGTA GTGGCCATTA TTATCCATCT

4501      TAAGTGACTG ATTAGATGCA TTGATCCCTC GACCAATTCC GGTTATTTTC
          ATTCACTGAC TAATCTACGT AACTAGGGAG CTGGTTAAGG CCAATAAAAG

4551      CACCATATTG CCGTCTTTTG GCAATGTGAG GGCCCGGAAA CCTGGCCCTG
          GTGGTATAAC GGCAGAAAAC CGTTACACTC CCGGGCCTTT GGACCGGGAC
```

FIG.10B-11

pICAST ALC

4601 TCTTCTTGAC GAGCATTCCT AGGGGTCTTT CCCCTCTCGC CAAAGGAATG
AGAAGAACTG CTCGTAAGGA TCCCCAGAAA GGGGAGAGCG GTTTCCTTAC

4651 CAAGGTCTGT TGAATGTCGT GAAGGAAGCA GTTCCTCTGG AAGCTTCTTG
GTTCCAGACA ACTTACAGCA CTTCCTTCGT CAAGGAGACC TTCGAAGAAC

4701 AAGACAAACA ACGTCTGTAG CGACCCTTTG CAGGCAGCGG AACCCCCCAC
TTCTGTTTGT TGCAGACATC GCTGGGAAAC GTCCGTCGCC TTGGGGGGTG

4751 CTGGCGACAG GTGCCTCTGC GGCCAAAAGC CACGTGTATA AGATACACCT
GACCGCTGTC CACGGAGACG CCGGTTTTCG GTGCACATAT TCTATGTGGA

4801 GCAAAGGCGG CACAACCCCA GTGCCACGTT GTGAGTTGGA TAGTTGTGGA
CGTTTCCGCC GTGTTGGGGT CACGGTGCAA CACTCAACCT ATCAACACCT

4851 AAGAGTCAAA TGGCTCTCCT CAAGCGTATT CAACAAGGGG CTGAAGGATG
TTCTCAGTTT ACCGAGAGGA GTTCGCATAA GTTGTTCCCC GACTTCCTAC

4901 CCCAGAAGGT ACCCCATTGT ATGGGATCTG ATCTGGGGCC TCGGTGCACA
GGGTCTTCCA TGGGGTAACA TACCCTAGAC TAGACCCCGG AGCCACGTGT

4951 TGCTTTACAT GTGTTTAGTC GAGGTTAAAA AACGTCTAGG CCCCCCGAAC
ACGAAATGTA CACAAATCAG CTCCAATTTT TTGCAGATCC GGGGGGCTTG

5001 CACGGGGACG TGGTTTTCCT TTGAAAAACA CGATGATAAT ACCATGATTG

GTGCCCCTGC ACCAAAAGGA AACTTTTTGT GCTACTATTA TGGTACTAAC

5051 AACAAGATGG ATTGCACGCA GGTTCTCCGG CCGCTTGGGT GGAGAGGCTA
TTGTTCTACC TAACGTGCGT CCAAGAGGCC GGCGAACCCA CCTCTCCGAT

5101 TTCGGCTATG ACTGGGCACA ACAGACAATC GGCTGCTCTG ATGCCGCCGT
AAGCCGATAC TGACCCGTGT TGTCTGTTAG CCGACGAGAC TACGGCGGCA

5151 GTTCCGGCTG TCAGCGCAGG GGCGCCCGGT TCTTTTTGTC AAGACCGACC
CAAGGCCGAC AGTCGCGTCC CCGCGGGCCA AGAAAAACAG TTCTGGCTGG

FIG.10B-12

```
5201  TGTCCGGTGC CCTGAATGAA CTGCAGGACG AGGCAGCGCG GCTATCGTGG
      ACAGGCCACG GGACTTACTT GACGTCCTGC TCCGTCGCGC CGATAGCACC

5251  CTGGCCACGA CGGGCGTTCC TTGCGCAGCT GTGCTCGACG TTGTCACTGA
      GACCGGTGCT GCCCGCAAGG AACGCGTCGA CACGAGCTGC AACAGTGACT

5301  AGCGGGAAGG GACTGGCTGC TATTGGGCGA AGTGCCGGGG CAGGATCTCC
      TCGCCCTTCC CTGACCGACG ATAACCCGCT TCACGGCCCC GTCCTAGAGG

5351  TGTCATCTCA CCTTGCTCCT GCCGAGAAAG TATCCATCAT GGCTGATGCA
      ACAGTAGAGT GGAACGAGGA CGGCTCTTTC ATAGGTAGTA CCGACTACGT

5401  ATGCGGCGGC TGCATACGCT TGATCCGGCT ACCTGCCCAT TCGACCACCA
      TACGCCGCCG ACGTATGCGA ACTAGGCCGA TGGACGGGTA AGCTGGTGGT

5451  AGCGAAACAT CGCATCGAGC GAGCACGTAC TCGGATGGAA GCCGGTCTTG
      TCGCTTTGTA GCGTAGCTCG CTCGTGCATG AGCCTACCTT CGGCCAGAAC

5501  TCGATCAGGA TGATCTGGAC GAAGAGCATC AGGGGCTCGC GCCAGCCGAA
      AGCTAGTCCT ACTAGACCTG CTTCTCGTAG TCCCCGAGCG CGGTCGGCTT

5551  CTGTTCGCCA GGCTCAAGGC GCGCATGCCC GACGGCGAGG ATCTCGTCGT
      GACAAGCGGT CCGAGTTCCG CGCGTACGGG CTGCCGCTCC TAGAGCAGCA

5601  GACCCATGGC GATGCCTGCT TGCCGAATAT CATGGTGGAA AATGGCCGCT
      CTGGGTACCG CTACGGACGA ACGGCTTATA GTACCACCTT TTACCGGCGA

5651  TTTCTGGATT CATCGACTGT GGCCGGCTGG GTGTGGCGGA CCGCTATCAG
      AAAGACCTAA GTAGCTGACA CCGGCCGACC CACACCGCCT GGCGATAGTC

5701  GACATAGCGT TGGCTACCCG TGATATTGCT GAAGAGCTTG GCGGCGAATG
      CTGTATCGCA ACCGATGGGC ACTATAACGA CTTCTCGAAC CGCCGCTTAC

5751  GGCTGACCGC TTCCTCGTGC TTTACGGTAT CGCCGCTCCC GATTCGCAGC
      CCGACTGGCG AAGGAGCACG AAATGCCATA GCGGCGAGGG CTAAGCGTCG
```


FIG.10B-13

```
5801  GCATCGCCTT CTATCGCCTT CTTGACGAGT TCTTCTGAGC GGGACTCTGG
      CGTAGCGGAA GATAGCGGAA GAACTGCTCA AGAAGACTCG CCCTGAGACC

5851  GGTTCGCATC GATAAAATAA AAGATTTTAT TTAGTCTCCA GAAAAAGGGG
      CCAAGCGTAG CTATTTTATT TTCTAAAATA AATCAGAGGT CTTTTTCCCC

5901  GGAATGAAAG ACCCCACCTG TAGGTTTGGC AAGCTAGCTT AAGTAACGCC
      CCTTACTTTC TGGGGTGGAC ATCCAAACCG TTCGATCGAA TTCATTGCGG

5951  ATTTTGCAAG GCATGGAAAA ATACATAACT GAGAATAGAG AAGTTCAGAT
      TAAAACGTTC CGTACCTTTT TATGTATTGA CTCTTATCTC TTCAAGTCTA

6001  CAAGGTCAGG AACAGATGGA ACAGCTGAAT ATGGGCCAAA CAGGATATCT
      GTTCCAGTCC TTGTCTACCT TGTCGACTTA TACCCGGTTT GTCCTATAGA

6051  GTGGTAAGCA GTTCCTGCCC CGGCTCAGGG CCAAGAACAG ATGGAACAGC
      CACCATTCGT CAAGGACGGG GCCGAGTCCC GGTTCTTGTC TACCTTGTCG

6101  TGAATATGGG CCAAACAGGA TATCTGTGGT AAGCAGTTCC TGCCCCGGCT
      ACTTATACCC GGTTTGTCCT ATAGACACCA TTCGTCAAGG ACGGGGCCGA

6151  CAGGGCCAAG AACAGATGGT CCCCAGATGC GGTCCAGCCC TCAGCAGTTT
      GTCCCGGTTC TTGTCTACCA GGGGTCTACG CCAGGTCGGG AGTCGTCAAA

6201  CTAGAGAACC ATCAGATGTT TCCAGGGTGC CCCAAGGACC TGAAATGACC
      GATCTCTTGG TAGTCTACAA AGGTCCCACG GGGTTCCTGG ACTTTACTGG

6251  CTGTGCCTTA TTTGAACTAA CCAATCAGTT CGCTTCTCGC TTCTGTTCGC
      GACACGGAAT AAACTTGATT GGTTAGTCAA GCGAAGAGCG AAGACAAGCG

6301  GCGCTTCTGC TCCCCGAGCT CAATAAAAGA GCCCACAACC CCTCACTCGG
      CGCGAAGACG AGGGGCTCGA GTTATTTTCT CGGGTGTTGG GGAGTGAGCC

6351  GGCGCCAGTC CTCCGATTGA CTGAGTCGCC CGGGTACCCG TGTATCCAAT
      CCGCGGTCAG GAGGCTAACT GACTCAGCGG GCCCATGGGC ACATAGGTTA
```

FIG.10B-14

```
6401    AAACCCTCTT GCAGTTGCAT CCGACTTGTG GTCTCGCTGT TCCTTGGGAG
        TTTGGGAGAA CGTCAACGTA GGCTGAACAC CAGAGCGACA AGGAACCCTC

6451    GGTCTCCTCT GAGTGATTGA CTACCCGTCA GCGGGGGTCT TTCATTCATG
        CCAGAGGAGA CTCACTAACT GATGGGCAGT CGCCCCCAGA AAGTAAGTAC

6501    CAGCATGTAT CAAAATTAAT TTGGTTTTTT TTCTTAAGTA TTTACATTAA
        GTCGTACATA GTTTTAATTA AACCAAAAAA AAGAATTCAT AAATGTAATT

6551    ATGGCCATAG TTGCATTAAT GAATCGGCCA ACGCGCGGGG AGAGGCGGTT
        TACCGGTATC AACGTAATTA CTTAGCCGGT TGCGCGCCCC TCTCCGCCAA

6601    TGCGTATTGG CGCTCTTCCG CTTCCTCGCT CACTGACTCG CTGCGCTCGG
        ACGCATAACC GCGAGAAGGC GAAGGAGCGA GTGACTGAGC GACGCGAGCC

6651    TCGTTCGGCT GCGGCGAGCG GTATCAGCTC ACTCAAAGGC GGTAATACGG
        AGCAAGCCGA CGCCGCTCGC CATAGTCGAG TGAGTTTCCG CCATTATGCC
```

FIG.10B-15

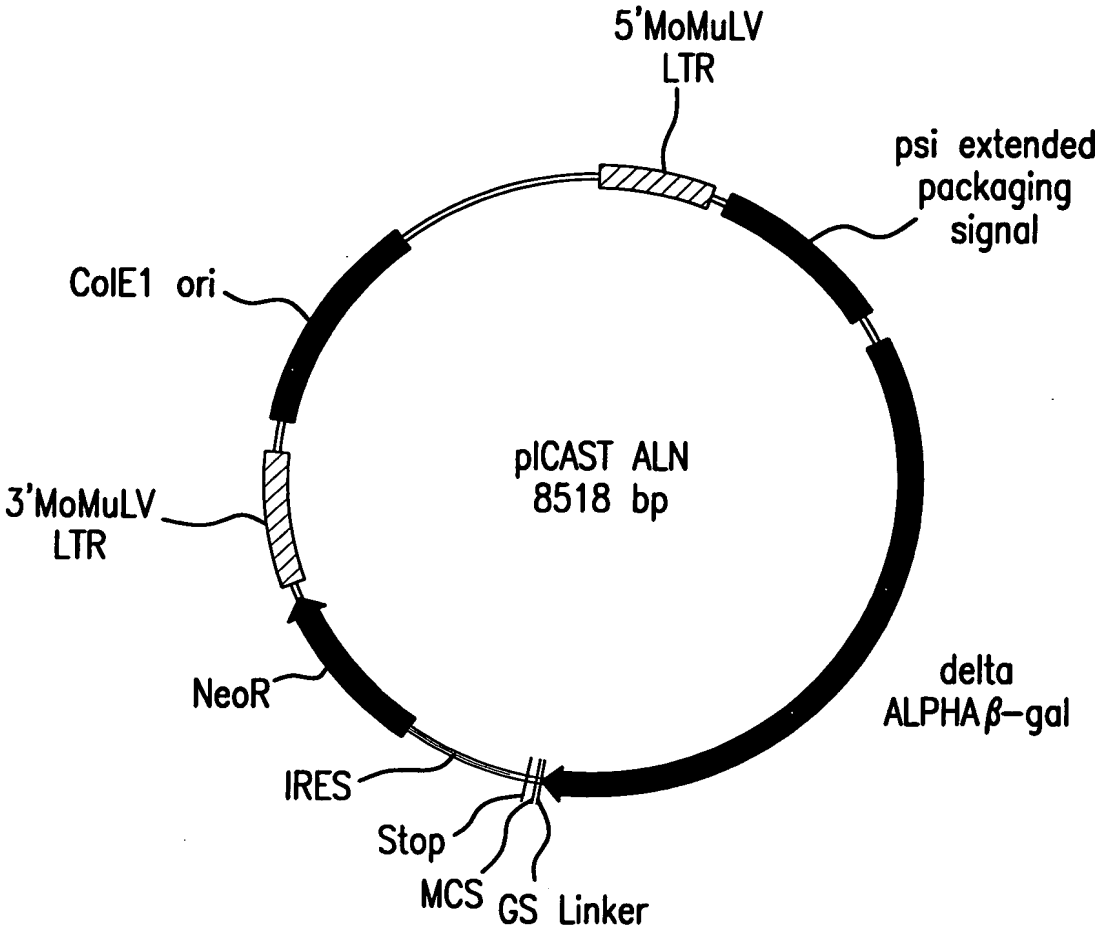

FIG.11A

pICAST ALN

```
CTGCAGCCTG AATATGGGCC AAACAGGATA TCTGTGGTAA GCAGTTCCTG CCCCGGCTCA     60
GACGTCGGAC TTATACCCGG TTTGTCCTAT AGACACCATT CGTCAAGGAC GGGGCCGAGT     60

GGGCCAAGAA CAGATGGAAC AGCTGAATAT GGGCCAAACA GGATATCTGT GGTAAGCAGT    120
CCCGGTTCTT GTCTACCTTG TCGACTTATA CCCGGTTTGT CCTATAGACA CCATTCGTCA    120

TCCTGCCCCG GCTCAGGGCC AAGAACAGAT GGTCCCCAGA TGCGGTCCAG CCCTCAGCAG    180
AGGACGGGGC CGAGTCCCGG TTCTTGTCTA CCAGGGGTCT ACGCCAGGTC GGGAGTCGTC    180

TTTCTAGAGA ACCATCAGAT GTTTCCAGGG TGCCCCAAGG ACCTGAAATG ACCCTGTGCC    240
AAAGATCTCT TGGTAGTCTA CAAAGGTCCC ACGGGGTTCC TGGACTTTAC TGGGACACGG    240

TTATTTGAAC TAACCAATCA GTTCGCTTCT CGCTTCTGTT CGCGCGCTTC TGCTCCCCGA    300
AATAAACTTG ATTGGTTAGT CAAGCGAAGA GCGAAGACAA GCGCGCGAAG ACGAGGGGCT    300

GCTCAATAAA AGAGCCCACA ACCCGTCACT CGGGGCGCCA GTCCTCCGAT TGACTGAGTC    360
CGAGTTATTT TCTCGGGTGT TGGGGAGTGA GCCCCGCGGT CAGGAGGCTA ACTGACTCAG    360

GCCCGGGTAC CCGTGTATCC AATAAACCCT CTTGCAGTTG CATCCGACTT GTGGTCTCGC    420
CGGGCCCATG GGCACATAGG TTATTTGGGA GAACGTCAAC GTAGGCTGAA CACCAGAGCG    420

TGTTCCTTGG GAGGGTCTCC TCTGAGTGAT TGACTACCCG TCAGCGGGGG TCTTTCATTT    480
ACAAGGAACC CTCCCAGAGG AGACTCACTA ACTGATGGGC AGTCGCCCCC AGAAAGTAAA    480

GGGGGCTCGT CCGGGATCGG GAGACCCCTG CCCAGGGACC ACCGACCCAC CACCGGGAGG    540
CCCCCGAGCA GGCCCTAGCC CTCTGGGGAC GGGTCCCTGG TGGCTGGGTG GTGGCCCTCC    540

CAAGCTGGCC AGCAACTTAT CTGTGTCTGT CCGATTGTCT AGTGTCTATG ACTGATTTTA    600
GTTCGACCGG TCGTTGAATA GACACAGACA GGCTAACAGA TCACAGATAC TGACTAAAAT    600

TGCGCCTGCG TCGGTACTAG TTAGCTAACT AGCTCTGTAT CTGGCGGACC CGTGGTGGAA    660
ACGCGGACGC AGCCATGATC AATCGATTGA TCGAGACATA GACCGCCTGG GCACCACCTT    660

CTGACGAGTT CTGAACACCC GGCCGCAACC CTGGGAGACG TCCCAGGGAC TTTGGGGGCC    720
GACTGCTCAA GACTTGTGGG CCGGCGTTGG GACCCTCTGC AGGGTCCCTG AAACCCCCGG    720

GTTTTTGTGG CCCGACCTGA GGAAGGGAGT CGATGTGGAA TCCGACCCCG TCAGGATATG    780
CAAAAACACC GGGCTGGACT CCTTCCCTCA GCTACACCTT AGGCTGGGGC AGTCCTATAC    780
```

FIG.11B-1

pICAST ALN

TGGTTCTGGT AGGAGACGAG AACCTAAAAC AGTTCCCGCC TCCGTCTGAA TTTTTGCTTT 840
ACCAAGACCA TCCTCTGCTC TTGGATTTTG TCAAGGGCGG AGGCAGACTT AAAAACGAAA 840

CGGTTTGGAA CCGAAGCCGC GCGTCTTGTC TGCTGCAGCA TCGTTCTGTG TTGTCTCTGT 900
GCCAAACCTT GGCTTCGGCG CGCAGAACAG ACGACGTCGT AGCAAGACAC AACAGAGACA 900

CTGACTGTGT TTCTGTATTT GTCTGAAAAT TAGGGCCAGA CTGTTACCAC TCCCTTAAGT 960
GACTGACACA AAGACATAAA CAGACTTTTA ATCCCGGTCT GACAATGGTG AGGGAATTCA 960

TTGACCTTAG GTAACTGGAA AGATGTCGAG CGGCTCGCTC ACAACCAGTC GGTAGATGTC 1020
AACTGGAATC CATTGACCTT TCTACAGCTC GCCGAGCGAG TGTTGGTCAG CCATCTACAG 1020

AAGAAGAGAC GTTGGGTTAC CTTCTGCTCT GCAGAATGGC CAACCTTTAA CGTCGGATGG 1080
TTCTTCTCTG CAACCCAATG GAAGACGAGA CGTCTTACCG GTTGGAAATT GCAGCCTACC 1080

CCGCGAGACG GCACCTTTAA CCGAGACCTC ATCACCCAGG TTAAGATCAA GGTCTTTTCA 1140
GGCGCTCTGC CGTGGAAATT GGCTCTGGAG TAGTGGGTCC AATTCTAGTT CCAGAAAAGT 1140

CCTGGCCCGC ATGGACACCC AGACCAGGTC CCCTACATCG TGACCTGGGA AGCCTTGGCT 1200
GGACCGGGCG TACCTGTGGG TCTGGTCCAG GGGATGTAGC ACTGGACCCT TCGGAACCGA 1200

TTTGACCCCC CTCCCTGGGT CAAGCCCTTT GTACACCCTA AGCCTCCGCC TCCTCTTCCT 1260
AAACTGGGGG GAGGGACCCA GTTCGGGAAA CATGTGGGAT TCGGAGGCGG AGGAGAAGGA 1260

CCATCCGCCC CGTCTCTCCC CCTTGAACCT CCTCGTTCGA CCCCGCCTCG ATCCTCCCTT 1320
GGTAGGCGGG GCAGAGAGGG GGAACTTGGA GGAGCAAGCT GGGGCGGAGC TAGGAGGGAA 1320

TATCCAGCCC TCACTCCTTC TCTAGGCGCC GGCCGCTCTA GCCCATTAAT ACGACTCACT 1380
ATAGGTCGGG AGTGAGGAAG AGATCCGCGG CCGGCGAGAT CGGGTAATTA TGCTGAGTGA 1380

ATAGGGCGAT TCGAACACCA TGCACCATCA TCATCATCAC GTCGACTATA AAGATGAGGA 1440
TATCCCGCTA AGCTTGTGGT ACGTGGTAGT AGTAGTAGTG CAGCTGATAT TTCTACTCCT 1440

CCTCGAGATG GGCGTGATTA CGGATTCACT GGCCGTCGTG GCCCGCACCG ATCGCCCTTC 1500
GGAGCTCTAC CCGCACTAAT GCCTAAGTGA CCGGCAGCAC CGGGCGTGGC TAGCGGGAAG 1500

CCAACAGTTA CGCAGCCTGA ATGGCGAATG GCGCTTTGCC TGGTTTCCGG CACCAGAAGC 1560
GGTTGTCAAT GCGTCGGACT TACCGCTTAC CGCGAAACGG ACCAAAGGCC GTGGTCTTCG 1560

FIG. 11B-2

```
GGTGCCGGAA AGCTGGCTGG AGTGCGATCT TCCTGAGGCC GATACTGTCG TCGTCCCCTC   1620
CCACGGCCTT TCGACCGACC TCACGCTAGA AGGACTCCGG CTATGACAGC AGCAGGGGAG   1620

AAACTGGCAG ATGCACGGTT ACGATGCGCC CATCTACACC AACGTGACCT ATCCCATTAC   1680
TTTGACCGTC TACGTGCCAA TGCTACGCGG GTAGATGTGG TTGCACTGGA TAGGGTAATG   1680

GGTCAATCCG CCGTTTGTTC CCACGGAGAA TCCGACGGGT TGTTACTCGC TCACATTTAA   1740
CCAGTTAGGC GGCAAACAAG GGTGCCTCTT AGGCTGCCCA ACAATGAGCG AGTGTAAATT   1740

TGTTGATGAA AGCTGGCTAC AGGAAGGCCA GACGCGAATT ATTTTTGATG GCGTTAACTC   1800
ACAACTACTT TCGACCGATG TCCTTCCGGT CTGCGCTTAA TAAAAACTAC CGCAATTGAG   1800

GGCGTTTCAT CTGTGGTGCA ACGGGCGCTG GGTCGGTTAC GGCCAGGACA GTCGTTTGCC   1860
CCGCAAAGTA GACACCACGT TGCCCGCGAC CCAGCCAATG CCGGTCCTGT CAGCAAACGG   1860

GTCTGAATTT GACCTGAGCG CATTTTTACG CGCCGGAGAA AACCGCCTCG CGGTGATGGT   1920
CAGACTTAAA CTGGACTCGC GTAAAAATGC GCGGCCTCTT TTGGCGGAGC GCCACTACCA   1920

GCTGGGCTGG AGTGACGGCA GTTATCTGGA AGATCAGGAT ATGTGGCGGA TGAGCGGCAT   1980
CGACGCGACC TCACTGCCGT CAATAGACCT TCTAGTCCTA TACACCGCCT ACTCGCCGTA   1980

TTTCCGTGAC GTCTCGTTGC TGCATAAACC GACTACACAA ATCAGCGATT TCCATGTTGC   2040
AAAGGCACTG CAGAGCAACG ACGTATTTGG CTGATGTGTT TAGTCGCTAA AGGTACAACG   2040

CACTCGCTTT AATGATGATT RCAGCCGCGC TGTACTGGAG GCTGAAGTTC AGATGTGCGG   2100
GTGAGCGAAA TTACTACTAA AGTCGGCGCG ACATGACCTC CGACTTCAAG TCTACACGCC   2100

CGAGTTGCGT GACTACCTAC GGGTAACAGT TTCTTTATGG CAGGGTGAAA CGCAGGTCGC   2160
GCTCAACGCA CTGATGGATG CCCATTGTCA AAGAAATACC GTCCCACTTT GCGTCCAGCG   2160

CAGCGGCACC GCGCCTTTCG GCGGTGAAAT TATCGATGAG CGTGGTGGTT ATGCCGATCG   2220
GTCGCCGTGG CGCGGAAAGC CGCCACTTTA ATAGCTACTC GCACCACCAA TACGGCTAGC   2220

CGTCACACTA CGTCTGAACG TCGAAAACCC GAAACTGTGG AGCGCCGAAA TCCCGAATCT   2280
GCAGTGTGAT GCAGACTTGC AGCTTTTGGG CTTTGACACC TCGCGGCTTT AGGGCTTAGA   2280

CTATCGTGCG GTGGTTGAAC TGCACACCGC CGACGGCACG CTGATTGAAG CAGAAGCCTG   2340
GATAGCACGC CACCAACTTG ACGTGTGGCG GCTGCCGTGC GACTAACTTC GTCTTCGGAC   2340
```

FIG.11B-3

pICAST ALN

CGATGTCGGT TTCCGCGAGG TGCGGATTGA AAATGGTCTG CTGCTGCTGA ACGGCAAGCC 2400
GCTACAGCCA AAGGCGCTCC ACGCCTAACT TTTACCAGAC GACGACGACT TGCCGTTCGG 2400

GTTGCTGATT CGAGGCGTTA ACCGTCACGA GCATCATCCT CTGCATGGTC AGGTCATGGA 2460
CAACGACTAA GCTCCGCAAT TGGCAGTGCT CGTAGTAGGA GACGTACCAG TCCAGTACCT 2460

TGAGCAGACG ATGGTGCAGG ATATCCTGCT GATGAAGCAG AACAACTTTA ACGCCGTGCG 2520
ACTCGTCTGC TACCACGTCC TATAGGACGA CTACTTCGTC TTGTTGAAAT TGCGGCACGC 2520

CTGTTCGCAT TATCCGAACC ATCCGCTGTG GTACACGCTG TGCGACCGCT ACGGCCTGTA 2580
GACAAGCGTA ATAGGCTTGG TAGGCGACAC CATGTGCGAC ACGCTGGCGA TGCCGGACAT 2580

TGTGGTGGAT GAAGCCAATA TTGAAACCCA CGGCATGGTG CCAATGAATC GTCTGACCGA 2640
ACACCACCTA CTTCGGTTAT AACTTTGGGT GCCGTACCAC GGTTACTTAG CAGACTGGCT 2640

TGATCCGCGC TGGCTACCGG CGATGAGCGA ACGCGTAACG CGAATGGTGC AGCGCGATCG 2700
ACTAGGCGCG ACCGATGGCC GCTACTCGCT TGCGCATTGC GCTTACCACG TCGCGCTAGC 2700

TAATCACCCG AGTGTGATCA TCTGGTCGCT GGGGAATGAA TCAGGCCACG GCGCTAATCA 2760
ATTAGTGGGC TCACACTAGT AGACCAGCGA CCCCTTACTT AGTCCGGTGC CGCGATTAGT 2760

CGACGCGCTG TATCGCTGGA TCAAATCTGT CGATCCTTCC CGCCCGGTGC AGTATGAAGG 2820
GCTGCGCGAC ATAGCGACCT AGTTTAGACA GCTAGGAAGG GCGGGCCACG TCATACTTCC 2820

CGGCGGAGCC GACACCACGG CCACCGATAT TATTTGCCCG ATGTACGCGC GCGTGGATGA 2880
GCCGCCTCGG CTGTGGTGCC GGTGGCTATA ATAAACGGGC TACATGCGCG CGCACCTACT 2880

AGACCAGCCC TTCCCGGCTG TGCCGAAATG GTCCATCAAA AAATGGCTTT CGCTACCTGG 2940
TCTGGTCGGG AAGGGCCGAC ACGGCTTTAC CAGGTAGTTT TTTACCGAAA GCGATGGACC 2940

AGAGACGCGC CCGCTGATCC TTTGCGAATA CGCCCACGCG ATGGGTAACA GTCTTGGCGG 3000
TCTCTGCGCG GGCGACTAGG AAACGCTTAT GCGGGTGCGC TACCCATTGT CAGAACCGCC 3000

TTTCGCTAAA TACTGGCAGG CGTTTCGTCA GTATCCCCGT TTACAGGGCG GCTTCGTCTG 3060
AAAGCGATTT ATGACCGTCC GCAAAGCAGT CATAGGGGCA AATGTCCCGC CGAAGCAGAC 3060

GGACTGGGTG GATCAGTCGC TGATTAAATA TGATGAAAAC GGCAACCCGT GGTCGGCTTA 3120
CCTGACCCAC CTAGTCAGCG ACTAATTTAT ACTACTTTTG CCGTTGGGCA CCAGCCGAAT 3120

FIG. 11B-4

pICAST ALN

CGGCGGTGAT TTTGGCGATA CGCCGAACGA TCGCCAGTTC TGTATGAACG GTCTGGTCTT 3180
GCCGCCACTA AAACCGCTAT GCGGCTTGCT AGCGGTCAAG ACATACTTGC CAGACCAGAA 3180

TGCCGACCGC ACGCCGCATC CAGCGCTGAC GGAAGCAAAA CACCAGCAGC AGTTTTTCCA 3240
ACGGCTGGCG TGCGGCGTAG GTCGCGACTG CCTTCGTTTT GTGGTCGTCG TCAAAAAGGT 3240

GTTCCGTTTA TCCGGGCAAA CCATCGAAGT GACCAGCGAA TACCTGTTCC GTCATAGCGA 3300
CAAGGCAAAT AGGCCCGTTT GGTAGCTTCA CTGGTCGCTT ATGGACAAGG CAGTATCGCT 3300

TAACGAGCTC CTGCACTGGA TGGTGGCGCT GGATGGTAAG CCGCTGGCAA GCGGTGAAGT 3360
ATTGCTCGAG GACGTGACCT ACCACCGCGA CCTACCATTC GGCGACCGTT CGCCACTTCA 3360

GCCTCTGGAT GTCGCTCCAC AAGGTAAACA GTTGATTGAA CTGCCTGAAC TACCGCAGCC 3420
CGGAGACCTA CAGCGAGGTG TTCCATTTGT CAACTAACTT GACGGACTTG ATGGCGTCGG 3420

GGAGAGCGCC GGGCAACTCT GGCTCACAGT ACGCGTAGTG CAACCGAACG CGACCGCATG 3480
CCTCTCGCGG CCCGTTGAGA CCGAGTGTCA TGCGCATCAC GTTGGCTTGC GCTGGCGTAC 3480

GTCAGAAGCC GGGCACATCA GCGCCTGGCA GCAGTGGCGT CTGGCGGAAA ACCTCAGTGT 3540
CAGTCTTCGG CCCGTGTAGT CGCGGACCGT CGTCACCGCA GACCGCCTTT TGGAGTCACA 3540

GACGCTCCCC GCCGCGTCCC ACGCCATCCC GCATCTGACC ACCAGCGAAA TGGATTTTTG 3600
CTGCGAGGGG CGGCGCAGGG TGCGGTAGGG CGTAGACTGG TGGTCGCTTT ACCTAAAAAC 3600

CATCGAGCTG GGTAATAAGC GTTGGCAATT TAACCGCCAG TCAGGCTTTC TTTCACAGAT 3660
GTAGCTCGAC CCATTATTCG CAACCGTTAA ATTGGCGGTC AGTCCGAAAG AAAGTGTCTA 3660

GTGGATTGGC GATAAAAAAC AACTGCTGAC GCCGCTGCGC GATCAGTTCA CCCGTGCACC 3720
CACCTAACCG CTATTTTTTG TTGACGACTG CGGCGACGCG CTAGTCAAGT GGGCACGTGG 3720

GCTGGATAAC GACATTGGCG TAAGTGAAGC GACCCGCATT GACCCTAACG CCTGGGTCGA 3780
CGACCTATTG CTGTAACCGC ATTCACTTCG CTGGGCGTAA CTGGGATTGC GGACCCAGCT 3780

ACGCTGGAAG GCGGCGGGCC ATTACCAGGC CGAAGCAGCG TTGTTGCAGT GCACGGCAGA 3840
TGCGACCTTC CGCCGCCCGG TAATGGTCCG GCTTCGTCGC AACAACGTCA CGTGCCGTCT 3840

TACACTTGCT GATGCGGTGC TGATTACGAC CGCTCACGCG TGGCAGCATC AGGGGAAAAC 3900
ATGTGAACGA CTACGCCACG ACTAATGCTG GCGAGTGCGC ACCGTCGTAG TCCCCTTTTG 3900

FIG.11B-5

CTTATTTATC AGCCGGAAAA CCTACCGGAT TGATGGTAGT GGTCAAATGG CGATTACCGT 3960
GAATAAATAG TCGGCCTTTT GGATGGCCTA ACTACCATCA CCAGTTTACC GCTAATGGCA 3960

TGATGTTGAA GTGGCGAGCG ATACACCGCA TCCGGCGCGG ATTGGCCTGA ACTGCCAGCT 4020
ACTACAACTT CACCGCTCGC TATGTGGCGT AGGCCGCGCC TAACCGGACT TGACGGTCGA 4020

GGCGCAGGTA GCAGAGCGGG TAAACTGGCT CGGATTAGGG CCGCAAGAAA ACTATCCCGA 4080
CCGCGTCCAT CGTCTCGCCC ATTTGACCGA GCCTAATCCC GGCGTTCTTT TGATAGGGCT 4080

CCGCCTTACT GCCGCCTGTT TTGACCGCTG GGATCTGCCA TTGTCAGACA TGTATACCCC 4140
GGCGGAATGA CGGCGGACAA AACTGGCGAC CCTAGACGGT AACAGTCTGT ACATATGGGG 4140

GTACGTCTTC CCGAGCGAAA ACGGTCTGCG CTGCGGGACG CGCGAATTGA ATTATGGCCC 4200
CATGCAGAAG GGCTCGCTTT TGCCAGACGC GACGCCCTGC GCGCTTAACT TAATACCGGG 4200

ACACCAGTGG CGCGGCGACT TCCAGTTCAA CATCAGCCGC TACAGTCAAC AGCAACTGAT 4260
TGTGGTCACC GCGCCGCTGA AGGTCAAGTT GTAGTCGGCG ATGTCAGTTG TCGTTGACTA 4260

GGAAACCAGC CATCGCCATC TGCTGCACGC GGAAGAAGGC ACATGGCTGA ATATCGACGG 4320
CCTTTGGTCG GTAGCGGTAG ACGACGTGCG CCTTCTTCCG TGTACCGACT TATAGCTGCC 4320

TTTCCATATG GGGATTGGTG GCGACGACTC CTGGAGCCCG TCAGTATCGG CGGAATTCCA 4380
AAAGGTATAC CCCTAACCAC CGCTGCTGAG GACCTCGGGC AGTCATAGCC GCCTTAAGGT 4380

GCTGAGCGCC GGTCGCTACC ATTACCAGTT GGTCTGGTGT CAAAAAAGAT CTGGAGGTGG 4440
CGACTCGCGG CCAGCGATGG TAATGGTCAA CCAGACCACA GTTTTTTCTA GACCTCCACC 4440

TGGCAGCAGG CCTTGGCGCG CCGGATCCTT AATTAACAAT TGACCGGTAA TAATAGGTAG 4500
ACCGTCGTCC GGAACCGCGC GGCCTAGGAA TTAATTGTTA ACTGGCCATT ATTATCCATC 4500

ATAAGTGACT GATTAGATGC ATTGATCCCT CGACCAATTC CGGTTATTTT CCACCATATT 4560
TATTCACTGA CTAATCTACG TAACTAGGGA GCTGGTTAAG GCCAATAAAA GGTGGTATAA 4560

GCCGTCTTTT GGCAATGTGA GGGCCCGGAA ACCTGGCCCT GTCTTCTTGA CGAGCATTCC 4620
CGGCAGAAAA CCGTTACACT CCCGGGCCTT TGGACCGGGA CAGAAGAACT GCTCGTAAGG 4620

TAGGGGTCTT TCCCCTCTCG CCAAAGGAAT GCAAGGTCTG TTGAATGTCG TGAAGGAAGC 4680
ATCCCCAGAA AGGGGAGAGC GGTTTCCTTA CGTTCCAGAC AACTTACAGC ACTTCCTTCG 4680

FIG.11B-6

```
AGTTCCTCTG GAAGCTTCTT GAAGACAAAC AACGTCTGTA GCGACCCTTT GCAGGCAGCG   4740
TCAAGGAGAC CTTCGAAGAA CTTCTGTTTG TTGCAGACAT CGCTGGGAAA CGTCCGTCGC   4740

GAACCCCCCA CCTGGCGACA GGTGCCTCTG CGGCCAAAAG CCACGTGTAT AAGATACACC   4800
CTTGGGGGGT GGACCGCTGT CCACGGAGAC GCCGGTTTTC GGTGCACATA TTCTATGTGG   4800

TGCAAAGGCG GCACAACCCC AGTGCCACGT TGTGAGTTGG ATAGTTGTGG AAAGAGTCAA   4860
ACGTTTCCGC CGTGTTGGGG TCACGGTGCA ACACTCAACC TATCAACACC TTTCTCAGTT   4860

ATGGCTCTCC TCAAGCGTAT TCAACAAGGG GCTGAAGGAT GCCCAGAAGG TACCCCATTG   4920
TACCGAGAGG AGTTCGCATA AGTTGTTCCC CGACTTCCTA CGGGTCTTCC ATGGGGTAAC   4920

TATGGGATCT GATCTGGGGC CTCGGTGCAC ATGCTTTACA TGTGTTTAGT CGAGGTTAAA   4980
ATACCCTAGA CTAGACCCCG GAGCCACGTG TACGAAATGT ACACAAATCA GCTCCAATTT   4980

AAACGTCTAG GCCCCCCGAA CCACGGGGAC GTGGTTTTCC TTTGAAAAAC ACGATGATAA   5040
TTTGCAGATC CGGGGGGCTT GGTGCCCCTG CACCAAAAGG AAACTTTTTG TGCTACTATT   5040

TACCATGATT GAACAAGATG GATTGCACGC AGGTTCTCCG GCCGCTTGGG TGGAGAGGCT   5100
ATGGTACTAA CTTGTTCTAC CTAACGTGCG TCCAAGAGGC CGGCGAACCC ACCTCTCCGA   5100

ATTCGGCTAT GACTGGGCAC AACAGACAAT CGGCTGCTCT GATGCCGCCG TGTTCCGGCT   5160
TAAGCCGATA CTGACCCGTG TTGTCTGTTA GCCGACGAGA CTACGGCGGC ACAAGGCCGA   5160

GTCAGCGCAG GGGCGCCCGG TTCTTTTTGT CAAGACCGAC CTGTCCGGTG CCCTGAATGA   5220
CAGTCGCGTC CCCGCGGGCC AAGAAAAACA GTTCTGGCTG GACAGGCCAC GGGACTTACT   5220

ACTGCAGGAC GAGGCAGCGC GGCTATCGTG GCTGGCCACG ACGGGCGTTC CTTGCGCAGC   5280
TGACGTCCTG CTCCGTCGCG CCGATAGCAC CGACCGGTGC TGCCCGCAAG GAACGCGTCG   5280

TGTGCTCGAC GTTGTCACTG AAGCGGGAAG GGACTGGCTG CTATTGGGCG AAGTGCCGGG   5340
ACACGAGCTG CAACAGTGAC TTCGCCCTTC CCTGACCGAC GATAACCCGC TTCACGGCCC   5340

GCAGGATCTC CTGTCATCTC ACCTTGCTCC TGCCGAGAAA GTATCCATCA TGGCTGATGC   5400
CGTCCTAGAG GACAGTAGAG TGGAACGAGG ACGGCTCTTT CATAGGTAGT ACCGACTACG   5400

AATGCGGCGG CTGCATACGC TTGATCCGGC TACCTGCCCA TTCGACCACC AAGCGAAACA   5460
TTACGCCGCC GACGTATGCG AACTAGGCCG ATGGACGGGT AAGCTGGTGG TTCGCTTTGT   5460
```

FIG. 11B-7

```
TCGCATCGAG CGAGCACGTA CTCGGATGGA AGCCGGTCTT GTCGATCAGG ATGATCTGGA   5520
AGCGTAGCTC GCTCGTGCAT GAGCCTACCT TCGGCCAGAA CAGCTAGTCC TACTAGACCT   5520

CGAAGAGCAT CAGGGGCTCG CGCCAGCCGA ACTGTTCGCC AGGCTCAAGG CGCGCATGCC   5580
GCTTCTCGTA GTCCCCGAGC GCGGTCGGCT TGACAAGCGG TCCGAGTTCC GCGCGTACGG   5580

CGACGGCGAG GATCTCGTCG TGACCCATGG CGATGCCTGC TTGCCGAATA TCATGGTGGA   5640
GCTGCCGCTC CTAGAGCAGC ACTGGGTACC GCTACGGACG AACGGCTTAT AGTACCACCT   5640

AAATGGCCGC TTTTCTGGAT TCATCGACTG TGGCCGGCTG GGTGTGGCGG ACCGCTATCA   5700
TTTACCGGCG AAAAGACCTA AGTAGCTGAC ACCGGCCGAC CCACACCGCC TGGCGATAGT   5700

GGACATAGCG TTGGCTACCC GTGATATTGC TGAAGAGCTT GGCGGCGAAT GGGCTGACCG   5760
CCTGTATCGC AACCGATGGG CACTATAACG ACTTCTCGAA CCGCCGCTTA CCCGACTGGC   5760

CTTCCTCGTG CTTTACGGTA TCGCCGCTCC CGATTCGCAG CGCATCGCCT TCTATCGCCT   5820
GAAGGAGCAC GAAATGCCAT AGCGGCGAGG GCTAAGCGTC GCGTAGCGGA AGATAGCGGA   5820

TCTTGACGAG TTCTTCTGAG CGGGACTCTG GGGTTCGCAT CGATAAAATA AAAGATTTTA   5880
AGAACTGCTC AAGAAGACTC GCCCTGAGAC CCCAAGCGTA GCTATTTTAT TTTCTAAAAT   5880

TTTAGTCTCC AGAAAAAGGG GGGAATGAAA GACCCCACCT GTAGGTTTGG CAAGCTAGCT   5940
AAATCAGAGG TCTTTTTCCC CCCTTACTTT CTGGGGTGGA CATCCAAACC GTTCGATCGA   5940

TAAGTAACGC CATTTTGCAA GGCATGGAAA AATACATAAC TGAGAATAGA GAAGTTCAGA   6000
ATTCATTGCG GTAAAACGTT CCGTACCTTT TTATGTATTG ACTCTTATCT CTTCAAGTCT   6000

TCAAGGTCAG GAACAGATGG AACAGCTGAA TATGGGCCAA ACAGGATATC TGTGGTAAGC   6060
AGTTCCAGTC CTTGTCTACC TTGTCGACTT ATACCCGGTT TGTCCTATAG ACACCATTCG   6060

AGTTCCTGCC CCGGCTCAGG GCCAAGAACA GATGGAACAG CTGAATATGG GCCAAACAGG   6120
TCAAGGACGG GGCCGAGTCC CGGTTCTTGT CTACCTTGTC GACTTATACC CGGTTTGTCC   6120

ATATCTGTGG TAAGCAGTTC CTGCCCCGGC TCAGGGCCAA GAACAGATGG TCCCCAGATG   6180
TATAGACACC ATTCGTCAAG GACGGGGCCG AGTCCCGGTT CTTGTCTACC AGGGGTCTAC   6180

CGGTCCAGCC CTCAGCAGTT TCTAGAGAAC CATCAGATGT TTCCAGGGTG CCCCAAGGAC   6240
GCCAGGTCGG GAGTCGTCAA AGATCTCTTG GTAGTCTACA AAGGTCCCAC GGGGTTCCTG   6240
```

FIG.11B-8

```
CTGAAATGAC CCTGTGCCTT ATTTGAACTA ACCAATCAGT TCGCTTCTCG CTTCTGTTCG   6300
GACTTTACTG GGACACGGAA TAAACTTGAT TGGTTAGTCA AGCGAAGAGC GAAGACAAGC   6300

CGCGCTTCTG CTCCCCGAGC TCAATAAAAG AGCCCACAAC CCCTCACTCG GGGCGCCAGT   6360
GCGCGAAGAC GAGGGGCTCG AGTTATTTTC TCGGGTGTTG GGGAGTGAGC CCCGCGGTCA   6360

CCTCCGATTG ACTGAGTCGC CCGGGTACCC GTGTATCCAA TAAACCCTCT TGCAGTTGCA   6420
GGAGGCTAAC TGACTCAGCG GGCCCATGGG CACATAGGTT ATTTGGGAGA ACGTCAACGT   6420

TCCGACTTGT GGTCTCGCTG TTCCTTGGGA GGGTCTCCTC TGAGTGATTG ACTACCCGTC   6480
AGGCTGAACA CCAGAGCGAC AAGGAACCCT CCCAGAGGAG ACTCACTAAC TGATGGGCAG   6480

AGCGGGGGTC TTTCATTCAT GCAGCATGTA TCAAAATTAA TTTGGTTTTT TTTCTTAAGT   6540
TCGCCCCCAG AAAGTAAGTA CGTCGTACAT AGTTTTAATT AAACCAAAAA AAAGAATTCA   6540

ATTTACATTA AATGGCCATA GTTGCATTAA TGAATCGGCC AACGCGCGGG GAGAGGCGGT   6600
TAAATGTAAT TTACCGGTAT CAACGTAATT ACTTAGCCGG TTGCGCGCCC CTCTCCGCCA   6600

AACGCATAAC CGCGAGAAGG CGAAGGAGCG AGTGACTGAG CGACGCGAGC CAGCAAGCCG   6660
TTGCGTATTG GCGCTCTTCC GCTTCCTCGC TCACTGACTC GCTGCGCTCG GTCGTTCGGC   6660

TGCGGCGAGC GGTATCAGCT CACTCAAAGG CGGTAATACG GTTATCCACA GAATCAGGGG   6720
ACGCCGCTCG CCATAGTCGA GTGAGTTTCC GCCATTATGC CAATAGGTGT CTTAGTCCCC   6720

ATAACGCAGG AAAGAACATG TGAGCAAAAG GCCAGCAAAA GGCCAGGAAC CGTAAAAAGG   6780
TATTGCGTCC TTTCTTGTAC ACTCGTTTTC CGGTCGTTTT CCGGTCCTTG GCATTTTTCC   6780

CCGCGTTGCT GGCGTTTTTC CATAGGCTCC GCCCCCCTGA CGAGCATCAC AAAAATCGAC   6840
GGCGCAACGA CCGCAAAAAG GTATCCGAGG CGGGGGGACT GCTCGTAGTG TTTTTAGCTG   6840

GCTCAAGTCA GAGGTGGCGA AACCCGACAG GACTATAAAG ATACCAGGCG TTTCCCCCTG   6900
CGAGTTCAGT CTCCACCGCT TTGGGCTGTC CTGATATTTC TATGGTCCGC AAAGGGGGAC   6900

GAAGCTCCCT CGTGCGCTCT CCTGTTCCGA CCCTGCCGCT TACCGGATAC CTGTCCGCCT   6960
CTTCGAGGGA GCACGCGAGA GGACAAGGCT GGGACGGCGA ATGGCCTATG GACAGGCGGA   6960

TTCTCCCTTC GGGAAGCGTG GCGCTTTCTC ATAGCTCACG CTGTAGGTAT CTCAGTTCGG   7020
AAGAGGGAAG CCCTTCGCAC CGCGAAAGAG TATCGAGTGC GACATCCATA GAGTCAAGCC   7020
```


FIG.11B-9

pICAST ALN

```
TGTAGGTCGT TCGCTCCAAG CTGGGCTGTG TGCACGAACC CCCCGTTCAG CCCGACCGCT   7080
ACATCCAGCA AGCGAGGTTC GACCCGACAC ACGTGCTTGG GGGGCAAGTC GGGCTGGCGA   7080

GCGCCTTATC CGGTAACTAT CGTCTTGAGT CCAACCCGGT AAGACACGAC TTATCGCCAC   7140
CGCGGAATAG GCCATTGATA GCAGAACTCA GGTTGGGCCA TTCTGTGCTG AATAGCGGTG   7140

TGGCAGCAGC CACTGGTAAC AGGATTAGCA GAGCGAGGTA TGTAGGCGGT GCTACAGAGT   7200
ACCGTCGTCG GTGACCATTG TCCTAATCGT CTCGCTCCAT ACATCCGCCA CGATGTCTCA   7200

TCTTGAAGTG GTGGCCTAAC TACGGCTACA CTAGAAGAAC AGTATTTGGT ATCTGCGCTC   7260
AGAACTTCAC CACCGGATTG ATGCCGATGT GATCTTCTTG TCATAAACCA TAGACGCGAG   7260

TGCTGAAGCC AGTTACCTTC GGAAAAAGAG TTGGTAGCTC TTGATCCGGC AAACAAACCA   7320
ACGACTTCGG TCAATGGAAG CCTTTTTCTC AACCATCGAG AACTAGGCCG TTTGTTTGGT   7320

CCGCTGGTAG CGGTGGTTTT TTTGTTTGCA AGCAGCAGAT TACGCGCAGA AAAAAAGGAT   7380
GGCGACCATC GCCACCAAAA AAACAAACGT TCGTCGTCTA ATGCGCGTCT TTTTTTCCTA   7380

CTCAAGAAGA TCCTTTGATC TTTTCTACGG GGTCTGACGC TCAGTGGAAC GAAAACTCAC   7440
GAGTTCTTCT AGGAAACTAG AAAAGATGCC CCAGACTGCG AGTCACCTTG CTTTTGAGTG   7440

GTTAAGGGAT TTTGGTCATG AGATTATCAA AAAGGATCTT CACCTAGATC CTTTTGCGGC   7500
CAATTCCCTA AAACCAGTAC TCTAATAGTT TTTCCTAGAA GTGGATCTAG GAAAACGCCG   7500

CGCAAATCAA TCTAAAGTAT ATATGAGTAA ACTTGGTCTG ACAGTTACCA ATGCTTAATC   7560
GCGTTTAGTT AGATTTCATA TATACTCATT TGAACCAGAC TGTCAATGGT TACGAATTAG   7560

AGTGAGGCAC CTATCTCAGC GATCTGTCTA TTTCGTTCAT CCATAGTTGC CTGACTCCCC   7620
TCACTCCGTG GATAGAGTCG CTAGACAGAT AAAGCAAGTA GGTATCAACG GACTGAGGGG   7620

GTCGTGTAGA TAACTACGAT ACGGGAGGGC TTACCATCTG GCCCCAGTGC TGCAATGATA   7680
CAGCACATCT ATTGATGCTA TGCCCTCCCG AATGGTAGAC CGGGGTCACG ACGTTACTAT   7680

CCGCGAGACC CACGCTCACC GGCTCCAGAT TTATCAGCAA TAAACCAGCC AGCCGGAAGG   7740
GGCGCTCTGG GTGCGAGTGG CCGAGGTCTA AATAGTCGTT ATTTGGTCGG TCGGCCTTCC   7740

GCCGAGCGCA GAAGTGGTCC TGCAACTTTA TCCGCCTCCA TCCAGTCTAT TAATTGTTGC   7800
CGGCTCGCGT CTTCACCAGG ACGTTGAAAT AGGCGGAGGT AGGTCAGATA ATTAACAACG   7800
```

FIG.11B-10

pICAST ALN

CGGGAAGCTA GAGTAAGTAG TTCGCCAGTT AATAGTTTGC GCAACGTTGT TGCCATTGCT 7860
GCCCTTCGAT CTCATTCATC AAGCGGTCAA TTATCAAACG CGTTGCAACA ACGGTAACGA 7860

ACAGGCATCG TGGTGTCACG CTCGTCGTTT GGTATGGCTT CATTCAGCTC CGGTTCCCAA 7920
TGTCCGTAGC ACCACAGTGC GAGCAGCAAA CCATACCGAA GTAAGTCGAG GCCAAGGGTT 7920

CGATCAAGGC GAGTTACATG ATCCCCCATG TTGTGCAAAA AAGCGGTTAG CTCCTTCGGT 7980
GCTAGTTCCG CTCAATGTAC TAGGGGGTAC AACACGTTTT TTCGCCAATC GAGGAAGCCA 7980

CCTCCGATCG TTGTCAGAAG TAAGTTGGCC GCAGTGTTAT CACTCATGGT TATGGCAGCA 8040
GGAGGCTAGC AACAGTCTTC ATTCAACCGG CGTCACAATA GTGAGTACCA ATACCGTCGT 8040

CTGCATAATT CTCTTACTGT CATGCCATCC GTAAGATGCT TTTCTGTGAC TGGTGAGTAC 8100
GACGTATTAA GAGAATGACA GTACGGTAGG CATTCTACGA AAAGACACTG ACCACTCATG 8100

TCAACCAAGT CATTCTGAGA ATAGTGTATG CGGCGACCGA GTTGCTCTTG CCCGGCGTCA 8160
AGTTGGTTCA GTAAGACTCT TATCACATAC GCCGCTGGCT CAACGAGAAC GGGCCGCAGT 8160

ATACGGGATA ATACCGCGCC ACATAGCAGA ACTTTAAAAG TGCTCATCAT TGGAAAACGT 8220
TATGCCCTAT TATGGCGCGG TGTATCGTCT TGAAATTTTC ACGAGTAGTA ACCTTTTGCA 8220

TCTTCGGGGC GAAAACTCTC AAGGATCTTA CCGCTGTTGA GATCCAGTTC GATGTAACCC 8280
AGAAGCCCCG CTTTTGAGAG TTCCTAGAAT GGCGACAACT CTAGGTCAAG CTACATTGGG 8280

ACTCGTGCAC CCAACTGATC TTCAGCATCT TTTACTTTCA CCAGCGTTTC TGGGTGAGCA 8340
TGAGCACGTG GGTTGACTAG AAGTCGTAGA AAATGAAAGT GGTCGCAAAG ACCCACTCGT 8340

AAAACAGGAA GGCAAAATGC CGCAAAAAAG GGAATAAGGG CGACACGGAA ATGTTGAATA 8400
TTTTGTCCTT CCGTTTTACG GCGTTTTTTC CCTTATTCCC GCTGTGCCTT TACAACTTAT 8400

CTCATACTCT TCCTTTTTCA ATATTATTGA AGCATTTATC AGGGTTATTG TCTCATGAGC 8460
GAGTATGAGA AGGAAAAAGT TATAATAACT TCGTAAATAG TCCCAATAAC AGAGTACTCG 8460

GGATACATAT TTGAATGTAT TTAGAAAAAT AAACAAATAG GGGTTCCGCG CACATTTC 8518
CCTATGTATA AACTTACATA AATCTTTTTA TTTGTTTATC CCCAAGGCGC GTGTAAAG 8518

FIG.11B-11

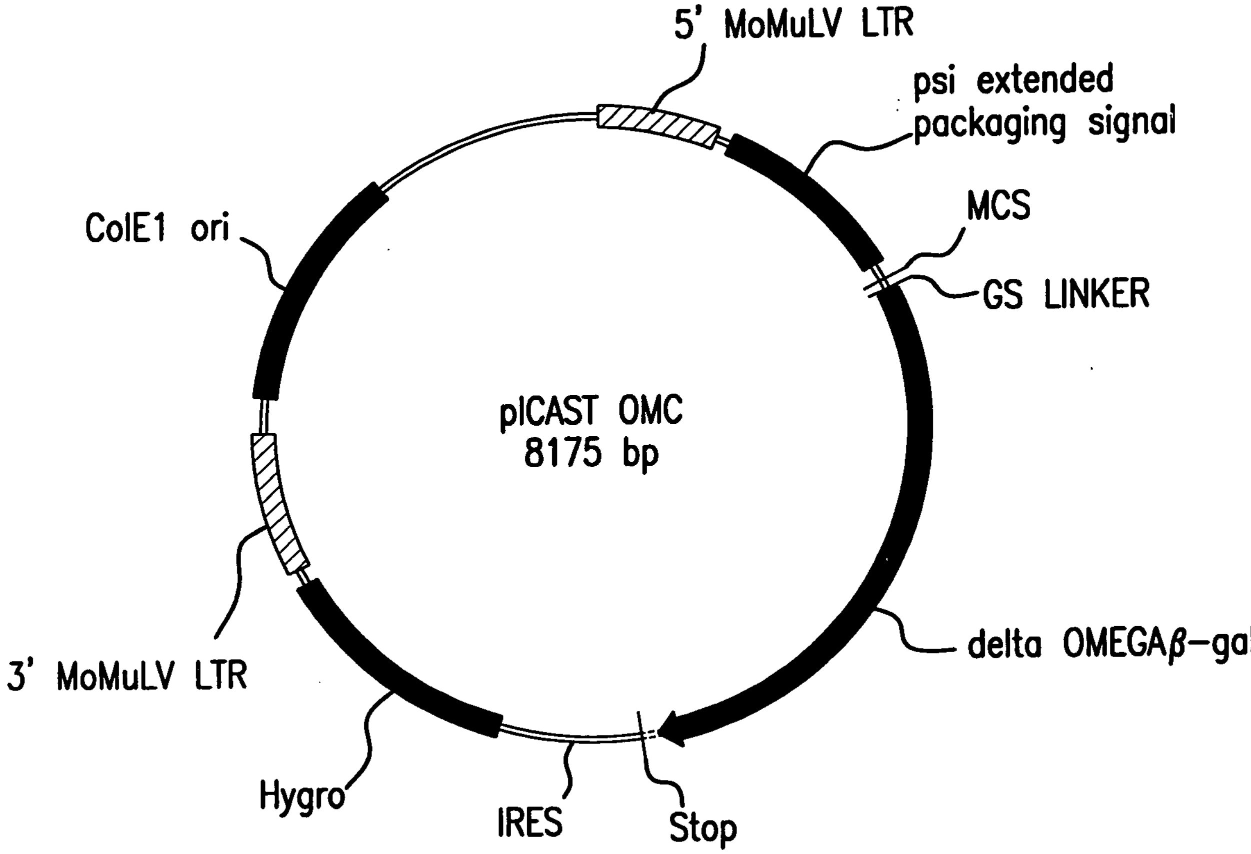

FIG.12A

pICAST OMC

```
CTGCAGCCTG AATATGGGCC AAACAGGATA TCTGTGGTAA GCAGTTCCTG CCCCGGCTCA     60
GACGTCGGAC TTATACCCGG TTTGTCCTAT AGACACCATT CGTCAAGGAC GGGGCCGAGT     60

GGGCCAAGAA CAGATGGAAC AGCTGAATAT GGGCCAAACA GGATATCTGT GGTAAGCAGT    120
CCCGGTTCTT GTCTACCTTG TCGACTTATA CCCGGTTTGT CCTATAGACA CCATTCGTCA    120

TCCTGCCCCG GCTCAGGGCC AAGAACAGAT GGTCCCCAGA TGCGGTCCAG CCCTCAGCAG    180
AGGACGGGGC CGAGTCCCGG TTCTTGTCTA CCAGGGGTCT ACGCCAGGTC GGGAGTCGTC    180

TTTCTAGAGA ACCATCAGAT GTTTCCAGGG TGCCCCAAGG ACCTGAAATG ACCCTGTGCC    240
AAAGATCTCT TGGTAGTCTA CAAAGGTCCC ACGGGGTTCC TGGACTTTAC TGGGACACGG    240

TTATTTGAAC TAACCAATCA GTTCGCTTCT CGCTTCTGTT CGCGCGCTTC TGCTCCCCGA    300
AATAAACTTG ATTGGTTAGT CAAGCGAAGA GCGAAGACAA GCGCGCGAAG ACGAGGGGCT    300

GCTCAATAAA AGAGCCCACA ACCCCTCACT CGGGGCGCCA GTCCTCCGAT TGACTGAGTC    360
CGAGTTATTT TCTCGGGTGT TGGGGAGTGA GCCCCGCGGT CAGGAGGCTA ACTGACTCAG    360

GCCCGGGTAC CCGTGTATCC AATAAACCCT CTTGCAGTTG CATCCGACTT GTGGTCTCGC    420
CGGGCCCATG GGCACATAGG TTATTTGGGA GAACGTCAAC GTAGGCTGAA CACCAGAGCG    420

TGTTCCTTGG GAGGYTCTCC TCTGAGTGAT TGACTACCCG TCAGCGGGGG TCTTTCATTT    480
ACAAGGAACC CTCCCAGAGG AGACTCACTA ACTGATGGGC AGTCGCCCCC AGAAAGTAAA    480

GGGGGCTCGT CCGGGATCGG GAGACCCCTG CCCAGGGACC ACCGACCCAC CACCGGGAGG    540
CCCCCGAGCA GGCCCTAGCC CTCTGGGGAC GGGTCCCTGG TGGCTGGGTG GTGGCCCTCC    540

CAAGCTGGCC AGCAACTTAT CTGTGTCTGT CCGATTGTCT AGTGTCTATG ACTGATTTTA    600
GTTCGACCGG TCGTTGAATA GACACAGACA GGCTAACAGA TCACAGATAC TGACTAAAAT    600

TGCGCCTGCG TCGGTACTAG TTAGCTAACT AGCTCTGTAT CTGGCGGACC CGTGGTGGAA    660
ACGCGGACGC AGCCATGATC AATCGATTGA TCGAGACATA GACCGCCTGG GCACCACCTT    660

CTGACGAGTT CTGAACACCC GGCCGCAACC CTGGGAGACG TCCCAGGGAC TTTGGGGGCC    720
GACTGCTCAA GACTTGTGGG CCGGCGTTGG GACCCTCTGC AGGGTCCCTG AAACCCCCGG    720

GTTTTTGTGG CCCGACCTGA GGAAGGGAGT CGATGTGGAA TCCGACCCCG TCAGGATATG    780
CAAAAACACC GGGCTGGACT CCTTCCCTCA GCTACACCTT AGGCTGGGGC AGTCCTATAC    780
```

FIG.12B-1

pICAST OMC

TGGTTCTGGT AGGAGACGAG AACCTAAAAC AGTTCCCGCC TCCGTCTGAA TTTTTGCTTT 840
ACCAAGACCA TCCTCTGCTC TTGGATTTTG TCAAGGGCGG AGGCAGACTT AAAAACGAAA 840

CGGTTTGGAA CCGAAGCCGC GCGTCTTGTC TGCTGCAGCA TCGTTCTGTG TTGTCTCTGT 900
GCCAAACCTT GGCTTCGGCG CGCAGAACAG ACGACGTCGT AGCAAGACAC AACAGAGACA 900

CTGACTGTGT TTCTGTATTT GTCTGAAAAT TAGGGCCAGA CTGTTACCAC TCCCTTAAGT 960
GACTGACACA AAGACATAAA CAGACTTTTA ATCCCGGTCT GACAATGGTG AGGGAATTCA 960

TTGACCTTAG GTAACTGGAA AGATGTCGAG CGGCTCGCTC ACAACCAGTC GGTAGATGTC 1020
AACTGGAATC CATTGACCTT TCTACAGCTC GCCGAGCGAG TGTTGGTCAG CCATCTACAG 1020

AAGAAGAGAC GTTGGGTTAC CTTCTGCTCT GCAGAATGGC CAACCTTTAA CGTCGGATGG 1080
TTCTTCTCTG CAACCCAATG GAAGACGAGA CGTCTTACCG GTTGGAAATT GCAGCCTACC 1080

CCGCGAGACG GCACCTTTAA CCGAGACCTC ATCACCCAGG TTAAGATCAA GGTCTTTTCA 1140
GGCGCTCTGC CGTGGAAATT GGCTCTGGAG TAGTGGGTCC AATTCTAGTT CCAGAAAAGT 1140

CCTGGCCCGC ATGGACACCC AGACCAGGTC CCCTACATCG TGACCTGGGA AGCCTTGGCT 1200
GGACCGGGCG TACCTGTGGG TCTGGTCCAG GGGATGTAGC ACTGGACCCT TCGGAACCGA 1200

TTTGACCCCC CTCCCTGGGT CAAGCCCTTT GTACACCCTA AGCCTCCGCC TCCTCTTCCT 1260
AAACTGGGGG GAGGGACCCA GTTCGGGAAA CATGTGGGAT TCGGAGGCGG AGGAGAAGGA 1260

CCATCCGCCC CGTCTCTCCC CCTTGAACCT CCTCGTTCGA CCCCGCCTCG ATCCTCCCTT 1320
GGTAGGCGGG GCAGAGAGGG GGAACTTGGA GGAGCAAGCT GGGGCGGAGC TAGGAGGGAA 1320

TATCCAGCCC TCACTCCTTC TCTAGGCGCC GGCCGCTCTA GCCCATTAAT ACGACTCACT 1380
ATAGGTCGGG AGTGAGGAAG AGATCCGCGG CCGGCGAGAT CGGGTAATTA TGCTGAGTGA 1380

ATAGGGCGAT TCGAATCAGG CCTTGGCGCG CCGGATCCTT AATTAAGCGC AATTGGGAGG 1440
TATCCCGCTA AGCTTAGTCC GGAACCGCGC GGCCTAGGAA TTAATTCGCG TTAACCCTCC 1440

TGGCGGTAGC CTCGAGATGG GCGTGATTAC GGATTCACTG GCCGTCGTTT TACAACGTCG 1500
ACCGCCATCG GAGCTCTACC CGCACTAATG CCTAAGTGAC CGGCAGCAAA ATGTTGCAGC 1500

TGACTGGGAA AACCCTGGCG TTACCCAACT TAATCGCCTT GCAGCACATC CCCCTTTCGC 1560
ACTGACCCTT TTGGGACCGC AATGGGTTGA ATTAGCGGAA CGTCGTGTAG GGGGAAAGCG 1560

FIG. 12B-2

pICAST OMC

CAGCTGGCGT AATAGCGAAG AGGCCCGCAC CGATCGCCCT TCCCAACAGT TACGCAGCCT 1620
GTCGACCGCA TTATCGCTTC TCCGGGCGTG GCTAGCGGGA AGGGTTGTCA ATGCGTCGGA 1620

GAATGGCGAA TGGCGCTTTG CCTGGTTTCC GGCACCAGAA GCGGTGCCGG AAAGCTGGCT 1680
CTTACCGCTT ACCGCGAAAC GGACCAAAGG CCGTGGTCTT CGCCACGGCC TTTCGACCGA 1680

GGAGTGCGAT CTTCCTGAGG CCGATACTGT CGTCGTCCCC TCAAACTGGC AGATGCACGG 1740
CCTCACGCTA GAAGGACTCC GGCTATGACA GCAGCAGGGG AGTTTGACCG TCTACGTGCC 1740

TTACGATGCG CCCATCTACA CCAACGTGAC CTATCCCATT ACGGTCAATC CGCCGTTTGT 1800
AATGCTACGC GGGTAGATGT GGTTGCACTG GATAGGGTAA TGCCAGTTAG GCGGCAAACA 1800

TCCCACGGAG AATCCGACGG GTTGTTACTC GCTCACATTT AATGTTGATG AAAGCTGGCT 1860
AGGGTGCCTC TTAGGCTGCC CAACAATGAG CGAGTGTAAA TTACAACTAC TTTCGACCGA 1860

ACAGGAAGGC CAGACGCGAA TTATTTTTGA TGGCGTTAAC TCGGCGTTTC ATCTGTGGTG 1920
TGTCCTTCCG GTCTGCGCTT AATAAAAACT ACCGCAATTG AGCCGCAAAG TAGACACCAC 1920

CAACGGGCGC TGGGTCGGTT ACGGCCAGGA CAGTCGTTTG CCGTCTGAAT TTGACCTGAG 1980
GTTGCCCGCG ACCCAGCCAA TGCCGGTCCT GTCAGCAAAC GGCAGACTTA AACTGGACTC 1980

CGCATTTTTA CGCGCCGGAG AAAACCGCCT CGCGGTGATG GTGCTGCGCT GGAGTGACGG 2040
GCGTAAAAAT GCGCGGCCTC TTTTGGCGGA GCGCCACTAC CACGACGCGA CCTCACTGCC 2040

CAGTTATCTG GAAGATCAGG ATATGTGGCG GATGAGCGGC ATTTTCCGTG ACGTCTCGTT 2100
GTCAATAGAC CTTCTAGTCC TATACACCGC CTACTCGCCG TAAAAGGCAC TGCAGAGCAA 2100

GCTGCATAAA CCGACTACAC AAATCAGCGA TTTCCATGTT GCCACTCGCT TTAATGATGA 2160
CGACGTATTT GGCTGATGTG TTTAGTCGCT AAAGGTACAA CGGTGAGCGA AATTACTACT 2160

TTTCAGCCGC GCTGTACTGG AGGCTGAAGT TCAGATGTGC GGCGAGTTGC GTGACTACCT 2220
AAAGTCGGCG CGACATGACC TCCGACTTCA AGTCTACACG CCGCTCAACG CACTGATGGA 2220

ACGGGTAACA GTTTCTTTAT GGCAGGGTGA AACGCAGGTC GCCAGCGGCA CCGCGCCTTT 2280
TGCCCATTGT CAAAGAAATA CCGTCCCACT TTGCGTCCAG CGGTCGCCGT GGCGCGGAAA 2280

CGGCGGTGAA ATTATCGATG AGCGTGGTGG TTATGCCGAT CGCGTCACAC TACGTCTGAA 2340
GCCGCCACTT TAATAGCTAC TCGCACCACC AATACGGCTA GCGCAGTGTG ATGCAGACTT 2340

FIG. 12B-3

pICAST OMC

CGTCGAAAAC CCGAAACTGT GGAGCGCCGA AATCCCGAAT CTCTATCGTG CGGTGGTTGA 2400
GCAGCTTTTG GGCTTTGACA CCTCGCGGCT TTAGGGCTTA GAGATAGCAC GCCACCAACT 2400

ACTGCACACC GCCGACGGCA CGCTGATTGA AGCAGAAGCC TGCGATGTCG GTTTCCGCGA 2460
TGACGTGTGG CGGCTGCCGT GCGACTAACT TCGTCTTCGG ACGCTACAGC CAAAGGCGCT 2460

GGTGCGGATT GAAAATGGTC TGCTGCTGCT GAACGGCAAG CCGTTGCTGA TTCGAGGCGT 2520
CCACGCCTAA CTTTTACCAG ACGACGACGA CTTGCCGTTC GGCAACGACT AAGCTCCGCA 2520

TAACCGTCAC GAGCATCATC CTCTGCATGG TCAGGTCATG GATGAGCAGA CGATGGTGCA 2580
ATTGGCAGTG CTCGTAGTAG GAGACGTACC AGTCCAGTAC CTACTCGTCT GCTACCACGT 2580

GGATATCCTG CTGATGAAGC AGAACAACTT TAACGCCGTG CGCTGTTCGC ATTATCCGAA 2640
CCTATAGGAC GACTACTTCG TCTTGTTGAA ATTGCGGCAC GCGACAAGCG TAATAGGCTT 2640

CCATCCGCTG TGGTACACGC TGTGCGACCG CTACGGCCTG TATGTGGTGG ATGAAGCCAA 2700
GGTAGGCGAC ACCATGTGCG ACACGCTGGC GATGCCGGAC ATACACCACC TACTTCGGTT 2700

TATTGAAACC CACGGCATGG TGCCAATGAA TCGTCTGACC GATGATCCGC GCTGGCTACC 2760
ATAACTTTGG GTGCCGTACC ACGGTTACTT AGCAGACTGG CTACTAGGCG CGACCGATGG 2760

GGCGATGAGC GAACGCGTAA CGCGAATGGT GCAGCGCGAT CGTAATCACC CGAGTGTGAT 2820
CCGCTACTCG CTTGCGCATT GCGCTTACCA CGTCGCGCTA GCATTAGTGG GCTCACACTA 2820

CATCTGGTCG CTGGGGAATG AATCAGGCCA CGGCGCTAAT CACGACGCGC TGTATCGCTG 2880
GTAGACCAGC GACCCCTTAC TTAGTCCGGT GCCGCGATTA GTGCTGCGCG ACATAGCGAC 2880

GATCAAATCT GTCGATCCTT CCCGCCCGGT GCAGTATGAA GGCGGCGGAG CCGACACCAC 2940
CTAGTTTAGA CAGCTAGGAA GGGCGGGCCA CGTCATACTT CCGCCGCCTC GGCTGTGGTG 2940

GGCCACCGAT ATTATTTGCC CGATGTACGC GCGCGTGGAT GAAGACCAGC CCTTCCCGGC 3000
CCGGTGGCTA TAATAAACGG GCTACATGCG CGCGCACCTA CTTCTGGTCG GGAAGGGCCG 3000

TGTGCCGAAA TGGTCCATCA AAAAATGGCT TTCGCTACCT GGAGAGACGC GCCCGCTGAT 3060
ACACGGCTTT ACCAGGTAGT TTTTTACCGA AAGCGATGGA CCTCTCTGCG CGGGCGACTA 3060

CCTTTGCGAA TACGCCCACG CGATGGGTAA CAGTCTTGGC GGTTTCGCTA AATACTGGCA 3120
GGAAACGCTT ATGCGGGTGC GCTACCCATT GTCAGAACCG CCAAAGCGAT TTATGACCGT 3120

FIG. 12B-4

pICAST OMC

GGCGTTTCGT CAGTATCCCC GTTTACAGGG CGGCTTCGTC TGGGACTGGG TGGATCAGTC 3180
CCGCAAAGCA GTCATAGGGG CAAATGTCCC GCCGAAGCAG ACCCTGACCC ACCTAGTCAG 3180

GCTGATTAAA TATGATGAAA ACGGCAACCC GTGGTCGGCT TACGGCGGTG ATTTTGGCGA 3240
CGACTAATTT ATACTACTTT TGCCGTTGGG CACCAGCCGA ATGCCGCCAC TAAAACCGCT 3240

TACGCCGAAC GATCGCCAGT TCTGTATGAA CGGTCTGGTC TTTGCCGACC GCACGCCGCA 3300
ATGCGGCTTG CTAGCGGTCA AGACATACTT GCCAGACCAG AAACGGCTGG CGTGCGGCGT 3300

TCCAGCGCTG ACGGAAGCAA AACACCAGCA GCAGTTTTTC CAGTTCCGTT TATCCGGGCA 3360
AGGTCGCGAC TGCCTTCGTT TTGTGGTCGT CGTCAAAAAG GTCAAGGCAA ATAGGCCCGT 3360

AACCATCGAA GTGACCAGCG AATACCTGTT CCGTCATAGC GATAACGAGC TCCTGCACTG 3420
TTGGTAGCTT CACTGGTCGC TTATGGACAA GGCAGTATCG CTATTGCTCG AGGACGTGAC 3420

GATGGTGGCG CTGGATGGTA AGCCGCTGGC AAGCGGTGAA GTGCCTCTGG ATGTCGCTCC 3480
CTACCACCGC GACCTACCAT TCGGCGACCG TTCGCCACTT CACGGAGACC TACAGCGAGG 3480

ACAAGGTAAA CAGTTGATTG AACTGCCTGA ACTACCGCAG CCGGAGAGCG CCGGGCAACT 3540
TGTTCCATTT GTCAACTAAC TTGACGGACT TGATGGCGTC GGCCTCTCGC GGCCCGTTGA 3540

CTGGCTCACA GTACGCGTAG TGCAACCGAA CGCGACCGCA TGGTCAGAAG CCGGGCACAT 3600
GACCGAGTGT CATGCGCATC ACGTTGGCTT GCGCTGGCGT ACCAGTCTTC GGCCCGTGTA 3600

CAGCGCCTGG CAGCAGTGGC GTCTGGCGGA AAACCTCAGT GTGACGCTCC CCGCCGCGTC 3660
GTCGCGGACC GTCGTCACCG CAGACCGCCT TTTGGAGTCA CACTGCGAGG GGCGGCGCAG 3660

CCACGCCATC CCGCATCTGA CCACCAGCGA AATGGATTTT TGCATCGAGC TGGGTAATAA 3720
GGTGCGGTAG GGCGTAGACT GGTGGTCGCT TTACCTAAAA ACGTAGCTCG ACCCATTATT 3720

GCGTTGGCAA TTTAACCGCC AGTCAGGCTT TCTTTCACAG ATGTGGATTG GCGATAAAAA 3780
CGCAACCGTT AAATTGGCGG TCAGTCCGAA AGAAAGTGTC TACACCTAAC CGCTATTTTT 3780

ACAACTGCTG ACGCCGCTGC GCGATCAGTT CACCCGTGTC GATAGATCTG AACAGAAACT 3840
TGTTGACGAC TGCGGCGACG CGCTAGTCAA GTGGGCACAG CTATCTAGAC TTGTCTTTGA 3840

CATTTCCGAA GAAGACCTAG TCGACCATCA TCATCATCAT CACCGGTAAT AATAGGTAGA 3900
GTAAAGGCTT CTTCTGGATC AGCTGGTAGT AGTAGTAGTA GTGGCCATTA TTATCCATCT 3900

FIG.12B-5

pICAST OMC

TAAGTGACTG ATTAGATGCA TTTCGACTAG ATCCCTCGAC CAATTCCGGT TATTTTCCAC 3960
ATTCACTGAC TAATCTACGT AAAGCTGATC TAGGGAGCTG GTTAAGGCCA ATAAAAGGTG 3960

CATATTGCCG TCTTTTGGCA ATGTGAGGGC CCGGAAACCT GGCCCTGTCT TCTTGACGAG 4020
GTATAACGGC AGAAAACCGT TACACTCCCG GGCCTTTGGA CCGGGACAGA AGAACTGCTC 4020

CATTCCTAGG GGTCTTTCCC CTCTCGCCAA AGGAATGCAA GGTCTGTTGA ATGTCGTGAA 4080
GTAAGGATCC CCAGAAAGGG GAGAGCGGTT TCCTTACGTT CCAGACAACT TACAGCACTT 4080

GGAAGCAGTT CCTCTGGAAG CTTCTTGAAG ACAAACAACG TCTGTAGCGA CCCTTTGCAG 4140
CCTTCGTCAA GGAGACCTTC GAAGAACTTC TGTTTGTTGC AGACATCGCT GGGAAACGTC 4140

GCAGCGGAAC CCCCCACCTG GCGACAGGTG CCTCTGCGGC CAAAAGCCAC GTGTATAAGA 4200
CGTCGCCTTG GGGGGTGGAC CGCTGTCCAC GGAGACGCCG GTTTTCGGTG CACATATTCT 4200

TACACCTGCA AAGGCGGCAC AACCCCAGTG CCACGTTGTG AGTTGGATAG TTGTGGAAAG 4260
ATGTGGACGT TTCCGCCGTG TTGGGGTCAC GGTGCAACAC TCAACCTATC AACACCTTTC 4260

AGTCAAATGG CTCTCCTCAA GCGTATTCAA CAAGGGGCTG AAGGATGCCC AGAAGGTACC 4320
TCAGTTTACC GAGAGGAGTT CGCATAAGTT GTTCCCCGAC TTCCTACGGG TCTTCCATGG 4320

CCATTGTATG GGATCTGATC TGGGGCCTCG GTGCACATGC TTTACATGTG TTTAGTCGAG 4380
GGTAACATAC CCTAGACTAG ACCCCGGAGC CACGTGTACG AAATGTACAC AAATCAGCTC 4380

GTTAAAAAAC GTCTAGGCCC CCCGAACCAC GGGGACGTGG TTTTCCTTTG AAAAACACGA 4440
CAATTTTTTG CAGATCCGGG GGGCTTGGTG CCCCTGCACC AAAAGGAAAC TTTTTGTGCT 4440

TGATAATACC ATGAAAAAGC CTGAACTCAC CGCGACGTCT GTCGAGAAGT TTCTGATCGA 4500
ACTATTATGG TACTTTTTCG GACTTGAGTG GCGCTGCAGA CAGCTCTTCA AAGACTAGCT 4500

AAAGTTCGAC AGCGTCTCCG ACCTGATGCA GCTCTCGGAG GGCGAAGAAT CTCGTGCTTT 4560
TTTCAAGCTG TCGCAGAGGC TGGACTACGT CGAGAGCCTC CCGCTTCTTA GAGCACGAAA 4560

CAGCTTCGAT GTAGGAGGGC GTGGATATGT CCTGCGGGTA AATAGCTGCG CCGATGGTTT 4620
GTCGAAGCTA CATCCTCCCG CACCTATACA GGACGCCCAT TTATCGACGC GGCTACCAAA 4620

CTACAAAGAT CGTTATGTTT ATCGGCACTT TGCATCGGCC GCGCTCCCGA TTCCGGAAGT 4680
GATGTTTCTA GCAATACAAA TAGCCGTGAA ACGTAGCCGG CGCGAGGGCT AAGGCCTTCA 4680

FIG. 12B-6

```
GCTTGACATT GGGGAATTTA GCGAGAGCCT GACCTATTGC ATCTCCCGCC GTGCACAGGG   4740
CGAACTGTAA CCCCTTAAAT CGCRCTCGGA CTGGATAACG TAGAGGGCGG CACGTGTCCC   4740

TGTCACGTTG CAAGACCTGC CTGAAACCGA ACTGCCCGCT GTTCTGCAGC CGGTCGCGGA   4800
ACAGTGCAAC GTTCTGGACG GACTTTGGCT TGACGGGCGA CAAGACGTCG GCCAGCGCCT   4800

GGCCATGGAT GCGATCGCTG CGGCCGATCT TAGCCAGACG AGCGGGTTCG GCCCATTCGG   4860
CCGGTACCTA CGCTAGCGAC GCCGGCTAGA ATCGGTCTGC TCGCCCAAGC CGGGTAAGCC   4860

ACCGCAAGGA ATCGGTCAAT ACACTACATG GCGTGATTTC ATATGCGCGA TTGCTGATCC   4920
TGGCGTTCCT TAGCCAGTTA TGTGATGTAC CGCACTAAAG TATACGCGCT AACGACTAGG   4920

CCATGTGTAT CACTGGCAAA CTGTGATGGA CGACACCGTC AGTGCGTCCG TCGCGCAGGC   4980
GGTACACATA GTGACCGTTT GACACTACCT GCTGTGGCAG TCACGCAGGC AGCGCGTCCG   4980

TCTCGATGAG CTGATGCTTT GGGCCGAGGA CTGCCCCGAA GTCCGGCACC TCGTGCACGC   5040
AGAGCTACTC GACTACGAAA CCCGGCTCCT GACGGGGCTT CAGGCCGTGG AGCACGTGCG   5040

GGATTTCGGC TCCAACAATG TCCTGACGGA CAATGGCCGC ATAACAGCGG TCATTGACTG   5100
CCTAAAGCCG AGGTTGTTAC AGGACTGCCT GTTACCGGCG TATTGTCGCC AGTAACTGAC   5100

GAGCGAGGCG ATGTTCGGGG ATTCCCAATA CGAGGTCGCC AACATCTTCT TCTGGAGGCC   5160
CTCGCTCCGC TACAAGCCCC TAAGGGTTAT GCTCCAGCGG TTGTAGAAGA AGACCTCCGG   5160

GTGGTTGGCT TGTATGGAGC AGCAGACGCG CTACTTCGAG CGGAGGCATC CGGAGCTTGC   5220
CACCAACCGA ACATACCTCG TCGTCTGCGC GATGAAGCTC GCCTCCGTAG GCCTCGAACG   5220

AGGATCGCCG CGGCTCCGGG CGTATATGCT CCGCATTGGT CTTGACCAAC TCTATCAGAG   5280
TCCTAGCGGC GCCGAGGCCC GCATATACGA GGCGTAACCA GAACTGCTTG AGATAGTCTC   5280

CTTGGTTGAC GGCAATTTCG ATGATGCAGC TTGGGCGCAG GGTCGATGCG ACGCAATCGT   5340
GAACCAACTG CCGTTAAAGC TACTACGTCG AACCCGCGTC CCAGCTACGC TGCGTTAGCA   5340

CCGATCCGGA GCCGGGACTG TCGGGCGTAC ACAAATCGCC CGCAGAAGCG CGGCCGTCTG   5400
GGCTAGGCCT CGGCCCTGAC AGCCCGCATG TGTTTAGCGG GCGTCTTCGC GCCGGCAGAC   5400

GACCGATGGC TGTGTAGAAG TACTCGCCGA TAGTGGAAAC CGACGCCCCA GCACTCGTCC   5460
CTGGCTACCG ACACATCTTC ATGAGCGGCT ATCACCTTTG GCTGCGGGGT CGTGAGCAGG   5460
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FIG.12B-7

pICAST OMC

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GAGGGCAAAG GAATAGAGTA GATGCCGACC GGGATCTATC GATAAAATAA AAGATTTTAT   5520
CTCCCGTTTC CTTATCTCAT CTACGGCTGG CCCTAGATAG CTATTTTATT TTCTAAAATA   5520

TTAGTCTCCA GAAAAAGGGG GGAATGAAAG ACCCCACCTG TAGGTTTGGC AAGCTAGCTT   5580
AATCAGAGGT CTTTTTCCCC CCTTACTTTC TGGGGTGGAC ATCCAAACCG TTCGATCGAA   5580

AAGTAACGCC ATTTTGCAAG GCATGGAAAA ATACATAACT GAGAATAGAG AAGTTCAGAT   5640
TTCATTGCGG TAAAACGTTC CGTACCTTTT TATGTATTGA CTCTTATCTC TTCAAGTCTA   5640

CAAGGTCAGG AACAGATGGA ACAGCTGAAT ATGGGCCAAA CAGGATATCT GTGGTAAGCA   5700
GTTCCAGTCC TTGTCTACCT TGTCGACTTA TACCCGGTTT GTCCTATAGA CACCATTCGT   5700

GTTCCTGCCC CGGCTCAGGG CCAAGAACAG ATGGAACAGC TGAATATGGG CCAAACAGGA   5760
CAAGGACGGG GCCGAGTCCC GGTTCTTGTC TACCTTGTCG ACTTATACCC GGTTTGTCCT   5760

TATCTGTGGT AAGCAGTTCC TGCCCCGGCT CAGGGCCAAG AACAGATGGT CCCCAGATGC   5820
ATAGACACCA TTCGTCAAGG ACGGGGCCGA GTCCCGGTTC TTGTCTACCA GGGGTCTACG   5820

GGTCCAGCCC TCAGCAGTTT CTAGAGAACC ATCAGATGTT TCCAGGGTGC CCCAAGGACC   5880
CCAGGTCGGG AGTCGTCAAA GATCTCTTGG TAGTCTACAA AGGTCCCACG GGGTTCCTGG   5880

TGAAATGACC CTGTGCCTTA TTTGAACTAA CCAATCAGTT CGCTTCTCGC TTCTGTTCGC   5940
ACTTTACTGG GACACGGAAT AAACTTGATT GGTTAGTCAA GCGAAGAGCG AAGACAAGCG   5940

GCGCTTCTGC TCCCCGAGCT CAATAAAAGA GCCCACAACC CCTCACTCGG GGCGCCAGTC   6000
CGCGAAGACG AGGGGCTCGA GTTATTTTCT CGGGTGTTGG GGAGTGAGCC CCGCGGTCAG   6000

CTCCGATTGA CTGAGTCGCC CGGGTACCCG TGTATCCAAT AAACCCTCTT GCAGTTGCAT   6060
GAGGCTAACT GACTCAGCGG GCCCATGGGC ACATAGGTTA TTTGGGAGAA CGTCAACGTA   6060

CCGACTTGTG GTCTCGCTGT TCCTTGGGAG GGTCTCCTCT GAGTGATTGA CTACCCGTCA   6120
GGCTGAACAC CAGAGCGACA AGGAACCCTC CCAGAGGAGA CTCACTAACT GATGGGCAGT   6120

GCGGGGGTCT TTCATTCATG CAGCATGTAT CAAAATTAAT TTGGTTTTTT TTCTTAAGTA   6180
CGCCCCCAGA AAGTAAGTAC GTCGTACATA GTTTTAATTA AACCAAAAAA AAGAATTCAT   6180

TTTACATTAA ATGGCCATAG TTGCATTAAT GAATCGGCCA ACGCGCGGGG AGAGGCGGTT   6240
AAATGTAATT TACCGGTATC AACGTAATTA CTTAGCCGGT TGCGCGCCCC TCTCCGCCAA   6240
```


FIG.12B-8

```
TGCGTATTGG CGCTCTTCCG CTTCCTCGCT CACTGACTCG CTGCGCTCGG TCGTTCGGCT   6300
ACGCATAACC GCGAGAAGGC GAAGGAGCGA GTGACTGAGC GACGCGAGCC AGCAAGCCGA   6300

GCGGCGAGCG GTATCAGCTC ACTCAAAGGC GGTAATACGG TTATCCACAG AATCAGGGGA   6360
CGCCGCTCGC CATAGTCGAG TGAGTTTCCG CCATTATGCC AATAGGTGTC TTAGTCCCCT   6360

TAACGCAGGA AAGAACATGT GAGCAAAAGG CCAGCAAAAG GCCAGGAACC GTAAAAAGGC   6420
ATTGCGTCCT TTCTTGTACA CTCGTTTTCC GGTCGTTTTC CGGTCCTTGG CATTTTTCCG   6420

CGCGTTGCTG GCGTTTTTCC ATAGGCTCCG CCCCCCTGAC GAGCATCACA AAAATCGACG   6480
GCGCAACGAC CGCAAAAAGG TATCCGAGGC GGGGGGACTG CTCGTAGTGT TTTTAGCTGC   6480

CTCAAGTCAG AGGTGGCGAA ACCCGACAGG ACTATAAAGA TACCAGGCGT TTCCCCCTGG   6540
GAGTTCAGTC TCCACCGCTT TGGGCTGTCC TGATATTTCT ATGGTCCGCA AAGGGGGACC   6540

AAGCTCCCTC GTGCGCTCTC CTGTTCCGAC CCTGCCGCTT ACCGGATACC TGTCCGCCTT   6600
TTCGAGGGAG CACGCGAGAG GACAAGGCTG GGACGGCGAA TGGCCTATGG ACAGGCGGAA   6600

TCTCCCTTCG GGAAGCGTGG CGCTTTCTCA TAGCTCACGC TGTAGGTATC TCAGTTCGGT   6660
AGAGGGAAGC CCTTCGCACC GCGAAAGAGT ATCGAGTGCG ACATCCATAG AGTCAAGCCA   6660

GTAGGTCGTT CGCTCCAAGC TGGGCTGTGT GCACGAACCC CCCGTTCAGC CCGACCGCTG   6720
CATCCAGCAA GCGAGGTTCG ACCCGACACA CGTGCTTGGG GGGCAAGTCG GGCTGGCGAC   6720

CGCCTTATCC GGTAACTATC GTCTTGAGTC CAACCCGGTA AGACACGACT TATCGCCACT   6780
GCGGAATAGG CCATTGATAG CAGAACTCAG GTTGGGCCAT TCTGTGCTGA ATAGCGGTGA   6780

GGCAGCAGCC ACTGGTAACA GGATTAGCAG AGCGAGGTAT GTAGGCGGTG CTACAGAGTT   6840
CCGTCGTCGG TGACCATTGT CCTAATCGTC TCGCTCCATA CATCCGCCAC GATGTCTCAA   6840

CTTGAAGTGG TGGCCTAACT ACGGCTACAC TAGAAGAACA GTATTTGGTA TCTGCGCTCT   6900
GAACTTCACC ACCGGATTGA TGCCGATGTG ATCTTCTTGT CATAAACCAT AGACGCGAGA   6900

GCTGAAGCCA GTTACCTTCG GAAAAAGAGT TGGTAGCTCT TGATCCGGCA AACAAACCAC   6960
CGACTTCGGT CAATGGAAGC CTTTTTCTCA ACCATCGAGA ACTAGGCCGT TTGTTTGGTG   6960

CGCTGGTAGC GGTGGTTTTT TTGTTTGCAA GCAGCAGATT ACGCGCAGAA AAAAAGGATC   7020
GCGACCATCG CCACCAAAAA AACAAACGTT CGTCGTCTAA TGCGCGTCTT TTTTTCCTAG   7020
```


FIG.12B-9

pICAST OMC

TCAAGAAGAT CCTTTGATCT TTTCTACGGG GTCTGACGCT CAGTGGAACG AAAACTCACG 7080
AGTTCTTCTA GGAAACTAGA AAAGATGCCC CAGACTGCGA GTCACCTTGC TTTTGAGTGC 7080

TTAAGGGATT TTGGTCATGA GATTATCAAA AAGGATCTTC ACCTAGATCC TTTTAAATTA 7140
AATTCCCTAA AACCAGTACT CTAATAGTTT TTCCTAGAAG TGGATCTAGG AAAATTTAAT 7140

AAAATGAAGT TTGCGGCCGC AAATCAATCT AAAGTATATA TGAGTAAACT TGGTCTGACA 7200
TTTTACTTCA AACGCCGGCG TTTAGTTAGA TTTCATATAT ACTCATTTGA ACCAGACTGT 7200

GTTACCAATG CTTAATCAGT GAGGCACCTA TCTCAGCGAT CTGTCTATTT CGTTCATCCA 7260
CAATGGTTAC GAATTAGTCA CTCCGTGGAT AGAGTCGCTA GACAGATAAA GCAAGTAGGT 7260

TAGTTGCCTG ACTCCCCGTC GTGTAGATAA CTACGATACG GGAGGGCTTA CCATCTGGCC 7320
ATCAACGGAC TGAGGGGCAG CACATCTATT GATGCTATGC CCTCCCGAAT GGTAGACCGG 7320

CCAGTGCTGC AATGATACCG CGAGACCCAC GCTCACCGGC TCCAGATTTA TCAGCAATAA 7380
GGTCACGACG TTACTATGGC GCTCTGGGTG CGAGTGGCCG AGGTCTAAAT AGTCGTTATT 7380

ACCAGCCAGC CGGAAGGGCC GAGCGCAGAA GTGGTCCTGC AACTTTATCC GCCTCCATCC 7440
TGGTCGGTCG GCCTTCCCGG CTCGCGTCTT CACCAGGACG TTGAAATAGG CGGAGGTAGG 7440

AGTCTATTAA TTGTTGCCGG GAAGCTAGAG TAAGTAGTTC GCCAGTTAAT AGTTTGCGCA 7500
TCAGATAATT AACAACGGCC CTTCGATCTC ATTCATCAAG CGGTCAATTA TCAAACGCGT 7500

ACGTTGTTGC CATTGCTACA GGCATCGTGG TGTCACGCTC GTCGTTTGGT ATGGCTTCAT 7560
TGCAACAACG GTAACGATGT CCGTAGCACC ACAGTGCGAG CAGCAAACCA TACCGAAGTA 7560

TCAGCTCCGG TTCCCAACGA TCAAGGCGAG TTACATGATC CCCCATGTTG TGCAAAAAAG 7620
AGTCGAGGCC AAGGGTTGCT AGTTCCGCTC AATGTACTAG GGGGTACAAC ACGTTTTTTC 7620

CGGTTAGCTC CTTCGGTCCT CCGATCGTTG TCAGAAGTAA GTTGGCCGCA GTGTTATCAC 7680
GCCAATCGAG GAAGCCAGGA GGCTAGCAAC AGTCTTCATT CAACCGGCGT CACAATAGTG 7680

TCATGGTTAT GGCAGCACTG CATAATTCTC TTACTGTCAT GCCATCCGTA AGATGCTTTT 7740
AGTACCAATA CCGTCGTGAC GTATTAAGAG AATGACAGTA CGGTAGGCAT TCTACGAAAA 7740

CTGTGACTGG TGAGTACTCA ACCAAGTCAT TCTGAGAATA GTGTATGCGG CGACCGAGTT 7800
GACACTGACC ACTCATGAGT TGGTTCAGTA AGACTCTTAT CACATACGCC GCTGGCTCAA 7800

FIG.12B-10

```
GCTCTTGCCC GGCGTCAATA CGGGATAATA CCGCGCCACA TAGCAGAACT TTAAAAGTGC   7860
CGAGAACGGG CCGCAGTTAT GCCCTATTAT GGCGCGGTGT ATCGTCTTGA AATTTTCACG   7860

TCATCATTGG AAAACGTTCT TCGGGGCGAA AACTCTCAAG GATCTTACCG CTGTTGAGAT   7920
AGTAGTAACC TTTTGCAAGA AGCCCCGCTT TTGAGAGTTC CTAGAATGGC GACAACTCTA   7920

CCAGTTCGAT GTAACCCACT CGTGCACCCA ACTGATCTTC AGCATCTTTT ACTTTCACCA   7980
GGTCAAGCTA CATTGGGTGA GCACGTGGGT TGACTAGAAG TCGTAGAAAA TGAAAGTGGT   7980

GCGTTTCTGG GTGAGCAAAA ACAGGAAGGC AAAATGCCGC AAAAAAGGGA ATAAGGGCGA   8040
CGCAAAGACC CACTCGTTTT TGTCCTTCCG TTTTACGGCG TTTTTTCCCT TATTCCCGCT   8040

CACGGAAATG TTGAATACTC ATACTCTTCC TTTTTCAATA TTATTGAAGC ATTTATCAGG   8100
GTGCCTTTAC AACTTATGAG TATGAGAAGG AAAAAGTTAT AATAACTTCG TAAATAGTCC   8100

GTTATTGTCT CATGAGCGGA TACATATTTG AATGTATTTA GAAAAATAAA CAAATAGGGG   8160
CAATAACAGA GTACTCGCCT ATGTATAAAC TTACATAAAT CTTTTTATTT GTTTATCCCC   8160

TTCCGCGCAC ATTTC                                                    8175
AAGGCGCGTG TAAAG                                                    8175
```

FIG.12B-11

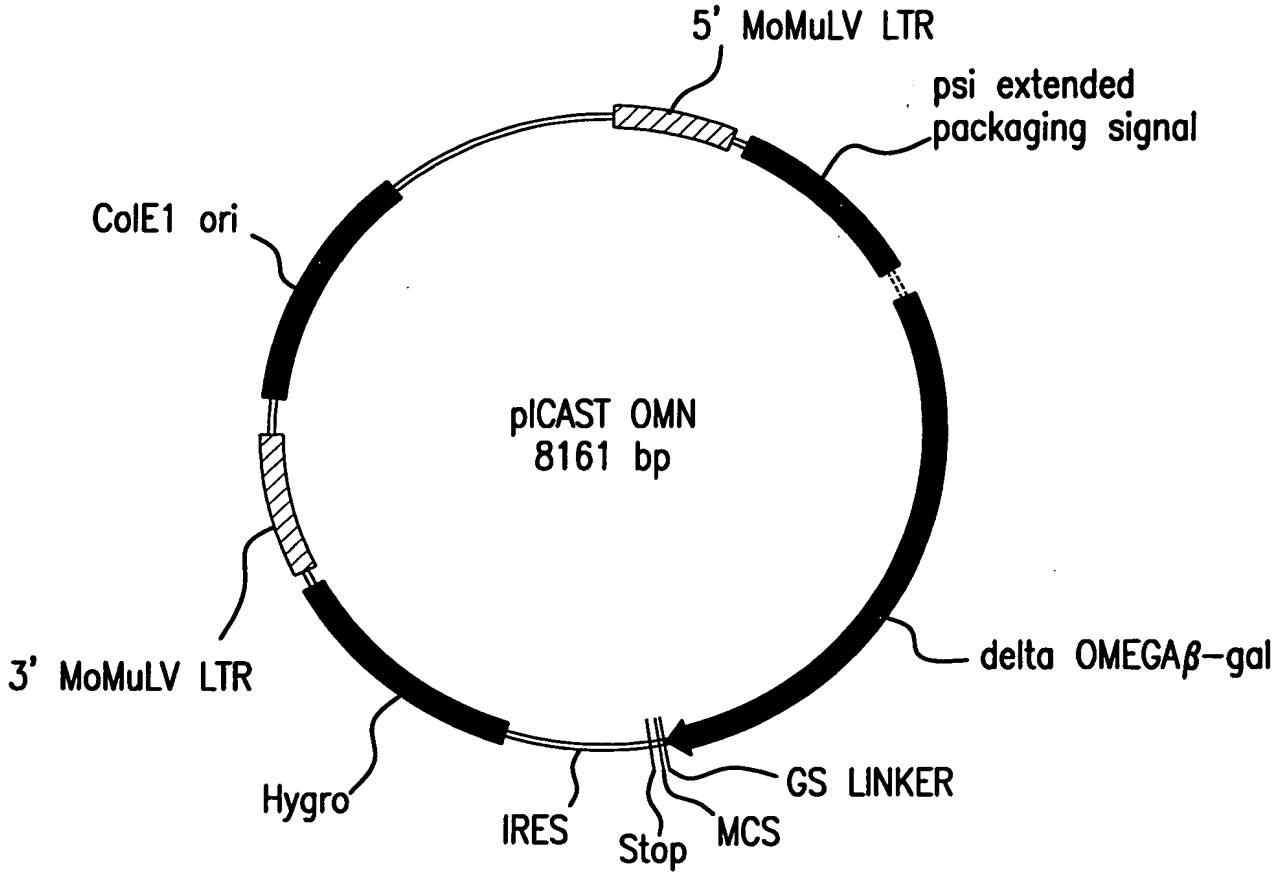
5' MoMuLV LTR
psi extended
packaging signal
ColE1 ori
pICAST OMN
8161 bp
3' MoMuLV LTR
delta OMEGAβ–gal
Hygro
IRES
Stop
MCS
GS LINKER

FIG.13A

```
CTGCAGCCTG AATATGGGCC AAACAGGATA TCTGTGGTAA GCAGTTCCTG CCCCGGCTCA     60
GACGTCGGAC TTATACCCGG TTTGTCCTAT AGACACCATT CGTCAAGGAC GGGGCCGAGT     60

GGGCCAAGAA CAGATGGAAC AGCTGAATAT GGGCCAAACA GGATATCTGT GGTAAGCAGT    120
CCCGGTTCTT GTCTACCTTG TCGACTTATA CCCGGTTTGT CCTATAGACA CCATTCGTCA    120

TCCTGCCCCG GCTCAGGGCC AAGAACAGAT GGTCCCCAGA TGCGGTCCAG CCCTCAGCAG    180
AGGACGGGGC CGAGTCCCGG TTCTTGTCTA CCAGGGGTCT ACGCCAGGTC GGGAGTCGTC    180

TTTCTAGAGA ACCATCAGAT GTTTCCAGGG TGCCCCAAGG ACCTGAAATG ACCCTGTGCC    240
AAAGATCTCT TGGTAGTCTA CAAAGGTCCC ACGGGGTTCC TGGACTTTAC TGGGACACGG    240

TTATTTGAAC TAACCAATCA GTTCGCTTCT CGCTTCTGTT CGCGCGCTTC TGCTCCCCGA    300
AATAAACTTG ATTGGTTAGT CAAGCGAAGA GCGAAGACAA GCGCGCGAAG ACGAGGGGCT    300

GCTCAATAAA AGAGCCCACA ACCCCTCACT CGGGGCGCCA GTCCTCCGAT TGACTGAGTC    360
CGAGTTATTT TCTCGGGTGT TGGGGAGTGA GCCCCGCGGT CAGGAGGCTA ACTGACTCAG    360

GCCCGGGTAC CCGTGTATCC AATAAACCCT CTTGCAGTTG CATCCGACTT GTGGTCTCGC    420
CGGGCCCATG GGCACATAGG TTATTTGGGA GAACGTCAAC GTAGGCTGAA CACCAGAGCG    420

TGTTCCTTGG GAGGGTCTCC TCTGAGTGAT TGACTACCCG TCAGCGGGGG TCTTTCATTT    480
ACAAGGAACC CTCCCAGAGG AGACTCACTA ACTGATGGGC AGTCGCCCCC AGAAAGTAAA    480

GGGGGCTCGT CCGGGATCGG GAGACCCCTG CCCAGGGACC ACCGACCCAC CACCGGGAGG    540
CCCCCGAGCA GGCCCTAGCC CTCTGGGGAC GGGTCCCTGG TGGCTGGGTG GTGGCCCTCC    540

CAAGCTGGCC AGCAACTTAT CTGTGTCTGT CCGATTGTCT AGTGTCTATG ACTGATTTTA    600
GTTCGACCGG TCGTTGAATA GACACAGACA GGCTAACAGA TCACAGATAC TGACTAAAAT    600

TGCGCCTGCG TCGGTACTAG TTAGCTAACT AGCTCTGTAT CTGGCGGACC CGTGGTGGAA    660
ACGCGGACGC AGCCATGATC AATCGATTGA TCGAGACATA GACCGCCTGG GCACCACCTT    660

CTGACGAGTT CTGAACACCC GGCCGCAACC CTGGGAGACG TCCCAGGGAC TTTGGGGGCC    720
GACTGCTCAA GACTTGTGGG CCGGCGTTGG GACCCTCTGC AGGGTCCCTG AAACCCCCGG    720

GTTTTTGTGG CCCGACCTGA GGAAGGGAGT CGATGTGGAA TCCGACCCCG TCAGGATATG    780
CAAAAACACC GGGCTGGACT CCTTCCCTCA GCTACACCTT AGGCTGGGGC AGTCCTATAC    780
```

FIG.13B-1

pICAST OMN

TGGTTCTGGT AGGAGACGAG AACCTAAAAC AGTTCCCGCC TCCGTCTGAA TTTTTGCTTT 840
ACCAAGACCA TCCTCTGCTC TTGGATTTTG TCAAGGGCGG AGGCAGACTT AAAAACGAAA 840

CGGTTTGGAA CCGAAGCCGC GCGTCTTGTC TGCTGCAGCA TCGTTCTGTG TTGTCTCTGT 900
GCCAAACCTT GGCTTCGGCG CGCAGAACAG ACGACGTCGT AGCAAGACAC AACAGAGACA 900

CTGACTGTGT TTCTGTATTT GTCTGAAAAT TAGGGCCAGA CTGTTACCAC TCCCTTAAGT 960
GACTGACACA AAGACATAAA CAGACTTTTA ATCCCGGTCT GACAATGGTG AGGGAATTCA 960

TTGACCTTAG GTAACTGGAA AGATGTCGAG CGGCTCGCTC ACAACCAGTC GGTAGATGTC 1020
AACTGGAATC CATTGACCTT TCTACAGCTC GCCGAGCGAG TGTTGGTCAG CCATCTACAG 1020

AAGAAGAGAC GTTGGGTTAC CTTCTGCTCT GCAGAATGGC CAACCTTTAA CGTCGGATGG 1080
TTCTTCTCTG CAACCCAATG GAAGACGAGA CGTCTTACCG GTTGGAAATT GCAGCCTACC 1080

CCGCGAGACG GCACCTTTAA CCGAGACCTC ATCACCCAGG TTAAGATCAA GGTCTTTTCA 1140
GGCGCTCTGC CGTGGAAATT GGCTCTGGAG TAGTGGGTCC AATTCTAGTT CCAGAAAAGT 1140

CCTGGCCCGC ATGGACACCC AGACCAGGTC CCCTACATCG TGACCTGGGA AGCCTTGGCT 1200
GGACCGGGCG TACCTGTGGG TCTGGTCCAG GGGATGTAGC ACTGGACCCT TCGGAACCGA 1200

TTTGACCCCC CTCCCTGGGT CAAGCCCTTT GTACACCCTA AGCCTCCGCC TCCTCTTCCT 1260
AAACTGGGGG GAGGGACCCA GTTCGGGAAA CATGTGGGAT TCGGAGGCGG AGGAGAAGGA 1260

CCATCCGCCC CGTCTCTCCC CCTTGAACCT CCTCGTTCGA CCCCGCCTCG ATCCTCCCTT 1320
GGTAGGCGGG GCAGAGAGGG GGAACTTGGA GGAGCAAGCT GGGGCGGAGC TAGGAGGGAA 1320

TATCCAGCCC TCACTCCTTC TCTAGGCGCC GGCCGCTCTA GCCCATTAAT ACGACTCACT 1380
ATAGGTCGGG AGTGAGGAAG AGATCCGCGG CCGGCGAGAT CGGGTAATTA TGCTGAGTGA 1380

ATAGGGCGAT TCGAACACCA TGCACCATCA TCATCATCAC GTCGACGAAC AGAAACTCAT 1440
TATCCCGCTA AGCTTGTGGT ACGTGGTAGT AGTAGTAGTG CAGCTGCTTG TCTTTGAGTA 1440

TTCCGAAGAA GACCTACTCG AGATGGGCGT GATTACGGAT TCACTGGCCG TCGTTTTACA 1500
AAGGCTTCTT CTGGATGAGC TCTACCCGCA CTAATGCCTA AGTGACCGGC AGCAAAATGT 1500

ACGTCGTGAC TGGGAAAACC CTGGCGTTAC CCAACTTAAT CGCCTTGCAG CACATCCCCC 1560
TGCAGCACTG ACCCTTTTGG GACCGCAATG GGTTGAATTA GCGGAACGTC GTGTAGGGGG 1560

FIG.13B-2

pICAST OMN

TTTCGCCAGC TGGCGTAATA GCGAAGAGGC CCGCACCGAT CGCCCTTCCC AACAGTTACG 1620
AAAGCGGTCG ACCGCATTAT CGCTTCTCCG GGCGTGGCTA GCGGGAAGGG TTGTCAATGC 1620

CAGCCTGAAT GGCGAATGGC GCTTTGCCTG GTTTCCGGCA CCAGAAGCGG TGCCGGAAAG 1680
GTCGGACTTA CCGCTTACCG CGAAACGGAC CAAAGGCCGT GGTCTTCGCC ACGGCCTTTC 1680

CTGGCTGGAG TGCGATCTTC CTGAGGCCGA TACTGTCGTC GTCCCCTCAA ACTGGCAGAT 1740
GACCGACCTC ACGCTAGAAG GACTCCGGCT ATGACAGCAG CAGGGGAGTT TGACCGTCTA 1740

GCACGGTTAC GATGCGCCCA TCTACACCAA CGTGACCTAT CCCATTACGG TCAATCCGCC 1800
CGTGCCAATG CTACGCGGGT AGATGTGGTT GCACTGGATA GGGTAATGCC AGTTAGGCGG 1800

GTTTGTTCCC ACGGAGAATC CGACGGGTTG TTACTCGCTC ACATTTAATG TTGATGAAAG 1860
CAAACAAGGG TGCCTCTTAG GCTGCCCAAC AATGAGCGAG TGTAAATTAC AACTACTTTC 1860

CTGGCTACAG GAAGGCCAGA CGCGAATTAT TTTTGATGGC GTTAACTCGG CGTTTCATCT 1920
GACCGATGTC CTTCCGGTCT GCGCTTAATA AAAACTACCG CAATTGAGCC GCAAAGTAGA 1920

GTGGTGCAAC GGGCGCTGGG TCGGTTACGG CCAGGACAGT CGTTTGCCGT CTGAATTTGA 1980
CACCACGTTG CCCGCGACCC AGCCAATGCC GGTCCTGTCA GCAAACGGCA GACTTAAACT 1980

CCTGAGCGCA TTTTTACGCG CCGGAGAAAA CCGCCTCGCG GTGATGGTGC TGCGCTGGAG 2040
GGACTCGCGT AAAAATGCGC GGCCTCTTTT GGCGGAGCGC CACTACCACG ACGCGACCTC 2040

TGACGGCAGT TATCTGGAAG ATCAGGATAT GTGGCGGATG AGCGGCATTT TCCGTGACGT 2100
ACTGCCGTCA ATAGACCTTC TAGTCCTATA CACCGCCTAC TCGCCGTAAA AGGCACTGCA 2100

CTCGTTGCTG CATAAACCGA CTACACAAAT CAGCGATTTC CATGTTGCCA CTCGCTTTAA 2160
GAGCAACGAC GTATTTGGCT GATGTGTTTA GTCGCTAAAG GTACAACGGT GAGCGAAATT 2160

TGATGATTTC AGCCGCGCTG TACTGGAGGC TGAAGTTCAG ATGTGCGGCG AGTTGCGTGA 2220
ACTACTAAAG TCGGCGCGAC ATGACCTCCG ACTTCAAGTC TACACGCCGC TCAACGCACT 2220

CTACCTACGG GTAACAGTTT CTTTATGGCA GGGTGAAACG CAGGTCGCCA GCGGCACCGC 2280
GATGGATGCC CATTGTCAAA GAAATACCGT CCCACTTTGC GTCCAGCGGT CGCCGTGGCG 2280

GCCTTTCGGC GGTGAAATTA TCGATGAGCG TGGTGGTTAT GCCGATCGCG TCACACTACG 2340
CGGAAAGCCG CCACTTTAAT AGCTACTCGC ACCACCAATA CGGCTAGCGC AGTGTGATGC 2340

FIG.13B-3

pICAST OMN

TCTGAACGTC GAAAACCCGA AACTGTGGAG CGCCGAAATC CCGAATCTCT ATCGTGCGGT 2400
AGACTTGCAG CTTTTGGGCT TTGACACCTC GCGGCTTTAG GGCTTAGAGA TAGCACGCCA 2400

GGTTGAACTG CACACCGCCG ACGGCACGCT GATTGAAGCA GAAGCCTGCG ATGTCGGTTT 2460
CCAACTTGAC GTGTGGCGGC TGCCGTGCGA CTAACTTCGT CTTCGGACGC TACAGCCAAA 2460

CCGCGAGGTG CGGATTGAAA ATGGTCTGCT GCTGCTGAAC GGCAAGCCGT TGCTGATTCG 2520
GGCGCTCCAC GCCTAACTTT TACCAGACGA CGACGACTTG CCGTTCGGCA ACGACTAAGC 2520

AGGCGTTAAC CGTCACGAGC ATCATCCTCT GCATGGTCAG GTCATGGATG AGCAGACGAT 2580
TCCGCAATTG GCAGTGCTCG TAGTAGGAGA CGTACCAGTC CAGTACCTAC TCGTCTGCTA 2580

GGTGCAGGAT ATCCTGCTGA TGAAGCAGAA CAACTTTAAC GCCGTGCGCT GTTCGCATTA 2640
CCACGTCCTA TAGGACGACT ACTTCGTCTT GTTGAAATTG CGGCACGCGA CAAGCGTAAT 2640

TCCGAACCAT CCGCTGTGGT ACACGCTGTG CGACCGCTAC GGCCTGTATG TGGTGGATGA 2700
AGGCTTGGTA GGCGACACCA TGTGCGACAC GCTGGCGATG CCGGACATAC ACCACCTACT 2700

AGCCAATATT GAAACCCACG GCATGGTGCC AATGAATCGT CTGACCGATG ATCCGCGCTG 2760
TCGGTTATAA CTTTGGGTGC CGTACCACGG TTACTTAGCA GACTGGCTAC TAGGCGCGAC 2760

GCTACCGGCG ATGAGCGAAC GCGTAACGCG AATGGTGCAG CGCGATCGTA ATCACCCGAG 2820
CGATGGCCGC TACTCGCTTG CGCATTGCGC TTACCACGTC GCGCTAGCAT TAGTGGGCTC 2820

TGTGATCATC TGGTCGCTGG GGAATGAATC AGGCCACGGC GCTAATCACG ACGCGCTGTA 2880
ACACTAGTAG ACCAGCGACC CCTTACTTAG TCCGGTGCCG CGATTAGTGC TGCGCGACAT 2880

TCGCTGGATC AAATCTGTCG ATCCTTCCCG CCCGGTGCAG TATGAAGGCG GCGGAGCCGA 2940
AGCGACCTAG TTTAGACAGC TAGGAAGGGC GGGCCACGTC ATACTTCCGC CGCCTCGGCT 2940

CACCACGGCC ACCGATATTA TTTGCCCGAT GTACGCGCGC GTGGATGAAG ACCAGCCCTT 3000
GTGGTGCCGG TGGCTATAAT AAACGGGCTA CATGCGCGCG CACCTACTTC TGGTCGGGAA 3000

CCCGGCTGTG CCGAAATGGT CCATCAAAAA ATGGCTTTCG CTACCTGGAG AGACGCGCCC 3060
GGGCCGACAC GGCTTTACCA GGTAGTTTTT TACCGAAAGC GATGGACCTC TCTGCGCGGG 3060

GCTGATCCTT TGCGAATACG CCCACGCGAT GGGTAACAGT CTTGGCGGTT TCGCTAAATA 3120
CGACTAGGAA ACGCTTATGC GGGTGCGCTA CCCATTGTCA GAACCGCCAA AGCGATTTAT 3120

FIG.13B-4

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CTGGCAGGCG TTTCGTCAGT ATCCCCGTTT ACAGGGCGGC TTCGTCTGGG ACTGGGTGGA   3180
GACCGTCCGC AAAGCAGTCA TAGGGGCAAA TGTCCCGCCG AAGCAGACCC TGACCCACCT   3180

TCAGTCGCTG ATTAAATATG ATGAAAACGG CAACCCGTGG TCGGCTTACG GCGGTGATTT   3240
AGTCAGCGAC TAATTTATAC TACTTTTGCC GTTGGGCACC AGCCGAATGC CGCCACTAAA   3240

TGGCGATACG CCGAACGATC GCCAGTTCTG TATGAACGGT CTGGTCTTTG CCGACCGCAC   3300
ACCGCTATGC GGCTTGCTAG CGGTCAAGAC ATACTTGCCA GACCAGAAAC GGCTGGCGTG   3300

GCCGCATCCA GCGCTGACGG AAGCAAAACA CCAGCAGCAG TTTTTCCAGT TCCGTTTATC   3360
CGGCGTAGGT CGCGACTGCC TTCGTTTTGT GGTCGTCGTC AAAAAGGTCA AGGCAAATAG   3360

CGGGCAAACC ATCGAAGTGA CCAGCGAATA CCTGTTCCGT CATAGCGATA ACGAGCTCCT   3420
GCCCGTTTGG TAGCTTCACT GGTCGCTTAT GGACAAGGCA GTATCGCTAT TGCTCGAGGA   3420

GCACTGGATG GTGGCGCTGG ATGGTAAGCC GCTGGCAAGC GGTGAAGTGC CTCTGGATGT   3480
CGTGACCTAC CACCGCGACC TACCATTCGG CGACCGTTCG CCACTTCACG GAGACCTACA   3480

CGCTCCACAA GGTAAACAGT TGATTGAACT GCCTGAACTA CCGCAGCCGG AGAGCGCCGG   3540
GCGAGGTGTT CCATTTGTCA ACTAACTTGA CGGACTTGAT GGCGTCGGCC TCTCGCGGCC   3540

GCAACTCTGG CTCACAGTAC GCGTAGTGCA ACCGAACGCG ACCGCATGGT CAGAAGCCGG   3600
CGTTGAGACC GAGTGTCATG CGCATCACGT TGGCTTGCGC TGGCGTACCA GTCTTCGGCC   3600

GCACATCAGC GCCTGGCAGC AGTGGCGTCT GGCGGAAAAC CTCAGTGTGA CGCTCCCCGC   3660
CGTGTAGTCG CGGACCGTCG TCACCGCAGA CCGCCTTTTG GAGTCACACT GCGAGGGGCG   3660

CGCGTCCCAC GCCATCCCGC ATCTGACCAC CAGCGAAATG GATTTTTGCA TCGAGCTGGG   3720
GCGCAGGGTG CGGTAGGGCG TAGACTGGTG GTCGCTTTAC CTAAAAACGT AGCTCGACCC   3720

TAATAAGCGT TGGCAATTTA ACCGCCAGTC AGGCTTTCTT TCACAGATGT GGATTGGCGA   3780
ATTATTCGCA ACCGTTAAAT TGGCGGTCAG TCCGAAAGAA AGTGTCTACA CCTAACCGCT   3780

TAAAAAACAA CTGCTGACGC CGCTGCGCGA TCAGTTCACC CGTGTCGATA GATCTGGAGG   3840
ATTTTTTGTT GACGACTGCG GCGACGCGCT AGTCAAGTGG GCACAGCTAT CTAGACCTCC   3840

TGGTGGCAGC AGGCCTTGGC GCGCCGGATC CTTAATTAAC AATTGACCGG TAATAATAGG   3900
ACCACCGTCG TCCGGAACCG CGCGGCCTAG GAATTAATTG TTAACTGGCC ATTATTATCC   3900
```


FIG.13B-5

```
TAGATAAGTG ACTGATTAGA TGCATTTCGA CTAGATCCCT CGACCAATTC CGGTTATTTT   3960
ATCTATTCAC TGACTAATCT ACGTAAAGCT GATCTAGGGA GCTGGTTAAG GCCAATAAAA   3960

CCACCATATT GCCGTCTTTT GGCAATGTGA GGGCCCGGAA ACCTGGCCCT GTCTTCTTGA   4020
GGTGGTATAA CGGCAGAAAA CCGTTACACT CCCGGGCCTT TGGACCGGGA CAGAAGAACT   4020

CGAGCATTCC TAGGGGTCTT TCCCCTCTCG CCAAAGGAAT GCAAGGTCTG TTGAATGTCG   4080
GCTCGTAAGG ATCCCCAGAA AGGGGAGAGC GGTTTCCTTA CGTTCCAGAC AACTTACAGC   4080

TGAAGGAAGC AGTTCCTCTG GAAGCTTCTT GAAGACAAAC AACGTCTGTA GCGACCCTTT   4140
ACTTCCTTCG TCAAGGAGAC CTTCGAAGAA CTTCTGTTTG TTGCAGACAT CGCTGGGAAA   4140

GCAGGCAGCG GAACCCCCCA CCTGGCGACA GGTGCCTCTG CGGCCAAAAG CCACGTGTAT   4200
CGTCCGTCGC CTTGGGGGGT GGACCGCTGT CCACGGAGAC GCCGGTTTTC GGTGCACATA   4200

AAGATACACC TGCAAAGGCG GCACAACCCC AGTGCCACGT TGTGAGTTGG ATAGTTGTGG   4260
TTCTATGTGG ACGTTTCCGC CGTGTTGGGG TCACGGTGCA ACACTCAACC TATCAACACC   4260

AAAGAGTCAA ATGGCTCTCC TCAAGCGTAT TCAACAAGGG GCTGAAGGAT GCCCAGAAGG   4320
TTTCTCAGTT TACCGAGAGG AGTTCGCATA AGTTGTTCCC CGACTTCCTA CGGGTCTTCC   4320

TACCCCATTG TATGGGATCT GATCTGGGGC CTCGGTGCAC ATGCTTTACA TGTGTTTAGT   4380
ATGGGGTAAC ATACCCTAGA CTAGACCCCG GAGCCACGTG TACGAAATGT ACACAAATCA   4380

CGAGGTTAAA AAACGTCTAG GCCCCCCGAA CCACGGGGAC GTGGTTTTCC TTTGAAAAAC   4440
GCTCCAATTT TTTGCAGATC CGGGGGGCTT GGTGCCCCTG CACCAAAAGG AAACTTTTTG   4440

ACGATGATAA TACCATGAAA AAGCCTGAAC TCACCGCGAC GTCTGTCGAG AAGTTTCTGA   4500
TGCTACTATT ATGGTACTTT TTCGGACTTG AGTGGCGCTG CAGACAGCTC TTCAAAGACT   4500

TCGAAAAGTT CGACAGCGTC TCCGACCTGA TGCAGCTCTC GGAGGGCGAA GAATCTCGTG   4560
AGCTTTTCAA GCTGTCGCAG AGGCTGGACT ACGTCGAGAG CCTCCCGCTT CTTAGAGCAC   4560

CTTTCAGCTT CGATGTAGGA GGGCGTGGAT ATGTCCTGCG GGTAAATAGC TGCGCCGATG   4620
GAAAGTCGAA GCTACATCCT CCCGCACCTA TACAGGACGC CCATTTATCG ACGCGGCTAC   4620

GTTTCTACAA AGATCGTTAT GTTTATCGGC ACTTTGCATC GGCCGCGCTC CCGATTCCGG   4680
CAAAGATGTT TCTAGCAATA CAAATAGCCG TGAAACGTAG CCGGCGCGAG GGCTAAGGCC   4680
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FIG.13B-6

```
AAGTGCTTGA CATTGGGGAA TTTAGCGAGA GCCTGACCTA TTGCATCTCC CGCCGTGCAC   4740
TTCACGAACT GTAACCCCTT AAATCGCTCT CGGACTGGAT AACGTAGAGG GCGGCACGTG   4740

AGGGTGTCAC GTTGCAAGAC CTGCCTGAAA CCGAACTGCC CGCTGTTCTG CAGCCGGTCG   4800
TCCCACAGTG CAACGTTCTG GACGGACTTT GGCTTGACGG GCGACAAGAC GTCGGCCAGC   4800

CGGAGGCCAT GGATGCGATC GCTGCGGCCG ATCTTAGCCA GACGAGCGGG TTCGGCCCAT   4860
GCCTCCGGTA CCTACGCTAG CGACGCCGGC TAGAATCGGT CTGCTCGCCC AAGCCGGGTA   4860

TCGGACCGCA AGGAATCGGT CAATACACTA CATGGCGTGA TTTCATATGC GCGATTGCTG   4920
AGCCTGGCGT TCCTTAGCCA GTTATGTGAT GTACCGCACT AAAGTATACG CGCTAACGAC   4920

ATCCCCATGT GTATCACTGG CAAACTGTGA TGGACGACAC CGTCAGTGCG TCCGTCGCGC   4980
TAGGGGTACA CATAGTGACC GTTTGACACT ACCTGCTGTG GCAGTCACGC AGGCAGCGCG   4980

AGGCTCTCGA TGAGCTGATG CTTTGGGCCG AGGACTGCCC CGAAGTCCGG CACCTCGTGC   5040
TCCGAGAGCT ACTCGACTAC GAAACCCGGC TCCTGACGGG GCTTCAGGCC GTGGAGCACG   5040

ACGCGGATTT CGGCTCCAAC AATGTCCTGA CGGACAATGG CCGCATAACA GCGGTCATTG   5100
TGCGCCTAAA GCCGAGGTTG TTACAGGACT GCCTGTTACC GGCGTATTGT CGCCAGTAAC   5100

ACTGGAGCGA GGCGATGTTC GGGGATTCCC AATACGAGGT CGCCAACATC TTCTTCTGGA   5160
TGACCTCGCT CCGCTACAAG CCCCTAAGGG TTATGCTCCA GCGGTTGTAG AAGAAGACCT   5160

GGCCGTGGTT GGCTTGTATG GAGCAGCAGA CGCGCTACTT CGAGCGGAGG CATCCGGAGC   5220
CCGGCACCAA CCGAACATAC CTCGTCGTCT GCGCGATGAA GCTCGCCTCC GTAGGCCTCG   5220

TTGCAGGATC GCCGCGGCTC CGGGCGTATA TGCTCCGCAT TGGTCTTGAC CAACTCTATC   5280
AACGTCCTAG CGGCGCCGAG GCCCGCATAT ACGAGGCGTA ACCAGAACTG GTTGAGATAG   5280

AGAGCTTGGT TGACGGCAAT TTCGATGATG CAGCTTGGGC GCAGGGTCGA TGCGACGCAA   5340
TCTCGAACCA ACTGCCGTTA AAGCTACTAC GTCGAACCCG CGTCCCAGCT ACGCTGCGTT   5340

TCGTCCGATC CGGAGCCGGG ACTGTCGGGC GTACACAAAT CGCCCGCAGA AGCGCGGCCG   5400
AGCAGGCTAG GCCTCGGCCC TGACAGCCCG CATGTGTTTA GCGGGCGTCT TCGCGCCGGC   5400

TCTGGACCGA TGGCTGTGTA GAAGTACTCG CCGATAGTGG AAACCGACGC CCCAGCACTC   5460
AGACCTGGCT ACCGACACAT CTTCATGAGC GGCTATCACC TTTGGCTGCG GGGTCGTGAG   5460
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FIG.13B-7

pICAST OMN

GTCCGAGGGC AAAGGAATAG AGTAGATGCC GACCGGGATC TATCGATAAA ATAAAAGATT 5520
CAGGCTCCCG TTTCCTTATC TCATCTACGG CTGGCCCTAG ATAGCTATTT TATTTTCTAA 5520

TTATTTAGTC TCCAGAAAAA GGGGGGAATG AAGACCCCAA CCTGTAGGTT TGGCAAGCTA 5580
AATAAATCAG AGGTCTTTTT CCCCCCTTAC TTTCTGGGGT GGACATCCAA ACCGTTCGAT 5580

GCTTAAGTAA CGCCATTTTG CAAGGCATGG AAAAATACAT AACTGAGAAT AGAGAAGTTC 5640
CGAATTCATT GCGGTAAAAC GTTCCGTACC TTTTTATGTA TTGACTCTTA TCTCTTCAAG 5640

AGATCAAGGT CAGGAACAGA TGGAACAGCT GAATATGGGC CAAACAGGAT ATCTGTGGTA 5700
TCTAGTTCCA GTCCTTGTCT ACCTTGTCGA CTTATACCCG GTTTGTCCTA TAGACACCAT 5700

AGCAGTTCCT GCCCCGGCTC AGGGCCAAGA ACAGATGGAA CAGCTGAATA TGGGCCAAAC 5760
TCGTCAAGGA CGGGGCCGAG TCCCGGTTCT TGTCTACCTT GTCGACTTAT ACCCGGTTTG 5760

AGGATATCTG TGGTAAGCAG TTCCTGCCCC GGCTCAGGGC CAAGAACAGA TGGTCCCCAG 5820
TCCTATAGAC ACCATTCGTC AAGGACGGGG CCGAGTCCCG GTTCTTGTCT ACCAGGGGTC 5820

ATGCGGTCCA GCCCTCAGCA GTTTCTAGAG AACCATCAGA TGTTTCCAGG GTGCCCCAAG 5880
TACGCCAGGT CGGGAGTCGT CAAAGATCTC TTGGTAGTCT ACAAAGGTCC CACGGGGTTC 5880

GACCTGAAAT GACCCTGTGC CTTATTTGAA CTAACCAATC AGTTCGCTTC TCGCTTCTGT 5940
CTGGACTTTA CTGGGACACG GAATAAACTT GATTGGTTAG TCAAGCGAAG AGCGAAGACA 5940

TCGCGCGCTT CTGCTCCCCG AGCTCAATAA AAGAGCCCAC AACCCCTCAC TCGGGGCGCC 6000
AGCGCGCGAA GACGAGGGGC TCGAGTTATT TTCTCGGGTG TTGGGGAGTG AGCCCCGCGG 6000

AGTCCTCCGA TTGACTGAGT CGCCCGGGTA CCCGTGTATC CAATAAACCC TCTTGCAGTT 6060
TCAGGAGGCT AACTGACTCA GCGGGCCCAT GGGCACATAG GTTATTTGGG AGAACGTCAA 6060

GCATCCGACT TGTGGTCTCG CTGTTCCTTG GGAGGGTCTC CTCTGAGTGA TTGACTACCC 6120
CGTAGGCTGA ACACCAGAGC GACAAGGAAC CCTCCCAGAG GAGACTCACT AACTGATGGG 6120

GTCAGCGGGG GTCTTTCATT CATGCAGCAT GTATCAAAAT TAATTTGGTT TTTTTTCTTA 6180
CAGTCGCCCC CAGAAAGTAA GTACGTCGTA CATAGTTTTA ATTAAACCAA AAAAAAGAAT 6180

AGTATTTACA TTAAATGGCC ATAGTTGCAT TAATGAATCG GCCAACGCGC GGGGAGAGGC 6240
TCATAAATGT AATTTACCGG TATCAACGTA ATTACTTAGC CGGTTGCGCG CCCCTCTCCG 6240

FIG.13B-8

pICAST OMN

GGTTTGCGTA TTGGCGCTCT TCCGCTTCCT CGCTCACTGA CTCGCTGCGC TCGGTCGTTC 6300
CCAAACGCAT AACCGCGAGA AGGCGAAGGA GCGAGTGACT GAGCGACGCG AGCCAGCAAG 6300

GGCTGCGGCG AGCGGTATCA GCTCACTCAA AGGCGGTAAT ACGGTTATCC ACAGAATCAG 6360
CCGACGCCGC TCGCCATAGT CGAGTGAGTT TCCGCCATTA TGCCAATAGG TGTCTTAGTC 6360

GGGATAACGC AGGAAAGAAC ATGTGAGCAA AAGGCCAGCA AAAGGCCAGG AACCGTAAAA 6420
CCCTATTGCG TCCTTTCTTG TACACTCGTT TTCCGGTCGT TTTCCGGTCC TTGGCATTTT 6420

AGGCCGCGTT GCTGGCGTTT TTCCATAGGC TCCGCCCCCC TGACGAGCAT CACAAAAATC 6480
TCCGGCGCAA CGACCGCAAA AAGGTATCCG AGGCGGGGGG ACTGCTCGTA GTGTTTTTAG 6480

GACGCTCAAG TCAGAGGTGG CGAAACCCGA CAGGACTATA AAGATACCAG GCGTTTCCCC 6540
CTGCGAGTTC AGTCTCCACC GCTTTGGGCT GTCCTGATAT TTCTATGGTC CGCAAAGGGG 6540

CTGGAAGCTC CCTCGTGCGC TCTCCTGTTC CGACCCTGCC GCTTACCGGA TACCTGTCCG 6600
GACCTTCGAG GGAGCACGCG AGAGGACAAG GCTGGGACGG CGAATGGCCT ATGGACAGGC 6600

CCTTTCTCCC TTCGGGAAGC GTGGCGCTTT CTCATAGCTC ACGCTGTAGG TATCTCAGTT 6660
GGAAAGAGGG AAGCCCTTCG CACCGCGAAA GAGTATCGAG TGCGACATCC ATAGAGTCAA 6660

CGGTGTAGGT CGTTCGCTCC AAGCTGGGCT GTGTGCACGA ACCCCCCGTT CAGCCCGACC 6720
GCCACATCCA GCAAGCGAGG TTCGACCCGA CACACGTGCT TGGGGGGCAA GTCGGGCTGG 6720

GCTGCGCCTT ATCCGGTAAC TATCGTCTTG AGTCCAACCC GGTAAGACAC GACTTATCGC 6780
CGACGCGGAA TAGGCCATTG ATAGCAGAAC TCAGGTTGGG CCATTCTGTG CTGAATAGCG 6780

CACTGGCAGC AGCCACTGGT AACAGGATTA GCAGAGCGAG GTATGTAGGC GGTGCTACAG 6840
GTGACCGTCG TCGGTGACCA TTGTCCTAAT CGTCTCGCTC CATACATCCG CCACGATGTC 6840

AGTTCTTGAA GTGGTGGCCT AACTACGGCT ACACTAGAAG AACAGTATTT GGTATCTGCG 6900
TCAAGAACTT CACCACCGGA TTGATGCCGA TGTGATCTTC TTGTCATAAA CCATAGACGC 6900

CTCTGCTGAA GCCAGTTACC TTCGGAAAAA GAGTTGGTAG CTCTTGATCC GGCAAACAAA 6960
GAGACGACTT CGGTCAATGG AAGCCTTTTT CTCAACCATC GAGAACTAGG CCGTTTGTTT 6960

CCACCGCTGG TAGCGGTGGT TTTTTTGTTT GCAAGCAGCA GATTACGCGC AGAAAAAAAG 7020
GGTGGCGACC ATCGCCACCA AAAAAACAAA CGTTCGTCGT CTAATGCGCG TCTTTTTTTC 7020

FIG.13B-9

```
GATCTCAAGA AGATCCTTTG ATCTTTTCTA CGGGGTCTGA CGCTCAGTGG AACGAAAACT   7080
CTAGAGTTCT TCTAGGAAAC TAGAAAAGAT GCCCCAGACT GCGAGTCACC TTGCTTTTGA   7080

CACGTTAAGG GATTTTGGTC ATGAGATTAT CAAAAAGGAT CTTCACCTAG ATCCTTTTGC   7140
GTGCAATTCC CTAAAACCAG TACTCTAATA GTTTTTCCTA GAAGTGGATC TAGGAAAACG   7140

GGCCGCAAAT CAATCTAAAG TATATATGAG TAAACTTGGT CTGACAGTTA CCAATGCTTA   7200
CCGGCGTTTA GTTAGATTTC ATATATACTC ATTTGAACCA GACTGTCAAT GGTTACGAAT   7200

ATCAGTGAGG CACCTATCTC AGCGATCTGT CTATTTCGTT CATCCATAGT TGCCTGACTC   7260
TAGTCACTCC GTGGATAGAG TCGCTAGACA GATAAAGCAA GTAGGTATCA ACGGACTGAG   7260

CCCGTCGTGT AGATAACTAC GATACGGGAG GGCTTACCAT CTGGCCCCAG TGCTGCAATG   7320
GGGCAGCACA TCTATTGATG CTATGCCCTC CCGAATGGTA GACCGGGGTC ACGACGTTAC   7320

ATACCGCGAG ACCCACGCTC ACCGGCTCCA GATTTATCAG CAATAAACCA GCCAGCCGGA   7380
TATGGCGCTC TGGGTGCGAG TGGCCGAGGT CTAAATAGTC GTTATTTGGT CGGTCGGCCT   7380

AGGGCCGAGC GCAGAAGTGG TCCTGCAACT TTATCCGCCT CCATCCAGTC TATTAATTGT   7440
TCCCGGCTCG CGTCTTCACC AGGACGTTGA AATAGGCGGA GGTAGGTCAG ATAATTAACA   7440

TGCCGGGAAG CTAGAGTAAG TAGTTCGCCA GTTAATAGTT TGCGCAACGT TGTTGCCATT   7500
ACGGCCCTTC GATCTCATTC ATCAAGCGGT CAATTATCAA ACGCGTTGCA ACAACGGTAA   7500

GCTACAGGCA TCGTGGTGTC ACGCTCGTCG TTTGGTATGG CTTCATTCAG CTCCGGTTCC   7560
CGATGTCCGT AGCACCACAG TGCGAGCAGC AAACCATACC GAAGTAAGTC GAGGCCAAGG   7560

CAACGATCAA GGCGAGTTAC ATGATCCCCC ATGTTGTGCA AAAAAGCGGT TAGCTCCTTC   7620
GTTGCTAGTT CCGCTCAATG TACTAGGGGG TACAACACGT TTTTTCGCCA ATCGAGGAAG   7620

GGTCCTCCGA TCGTTGTCAG AAGTAAGTTG GCCGCAGTGT TATCACTCAT GGTTATGGCA   7680
CCAGGAGGCT AGCAACAGTC TTCATTCAAC CGGCGTCACA ATAGTGAGTA CCAATACCGT   7680

GCACTGCATA ATTCTCTTAC TGTCATGCCA TCCGTAAGAT GCTTTTCTGT GACTGGTGAG   7740
CGTGACGTAT TAAGAGAATG ACAGTACGGT AGGCATTCTA CGAAAAGACA CTGACCACTC   7740

TACTCAACCA AGTCATTCTG AGAATAGTGT ATGCGGCGAC CGAGTTGCTC TTGCCCGGCG   7800
ATGAGTTGGT TCAGTAAGAC TCTTATCACA TACGCCGCTG GCTCAACGAG AACGGGCCGC   7800
```


FIG.13B-10

```
TCAATACGGG ATAATACCGC GCCACATAGC AGAACTTTAA AAGTGCTCAT CATTGGAAAA   7860
AGTTATGCCC TATTATGGCG CGGTGTATCG TCTTGAAATT TTCACGAGTA GTAACCTTTT   7860

CGTTCTTCGG GGCGAAAACT CTCAAGGATC TTACCGCTGT TGAGATCCAG TTCGATGTAA   7920
GCAAGAAGCC CCGCTTTTGA GAGTTCCTAG AATGGCGACA ACTCTAGGTC AAGCTACATT   7920

CCCACTCGTG CACCCAACTG ATCTTCAGCA TCTTTTACTT TCACCAGCGT TTCTGGGTGA   7980
GGGTGAGCAC GTGGGTTGAC TAGAAGTCGT AGAAAATGAA AGTGGTCGCA AAGACCCACT   7980

GCAAAAACAG GAAGGCAAAA TGCCGCAAAA AAGGGAATAA GGGCGACACG GAAATGTTGA   8040
CGTTTTTGTC CTTCCGTTTT ACGGCGTTTT TTCCCTTATT CCCGCTGTGC CTTTACAACT   8040

ATACTCATAC TCTTCCTTTT TCAATATTAT TGAAGCATTT ATCAGGGTTA TTGTCTCATG   8100
TATGAGTATG AGAAGGAAAA AGTTATAATA ACTTCGTAAA TAGTCCCAAT AACAGAGTAC   8100

AGCGGATACA TATTTGAATG TATTTAGAAA AATAAACAAA TAGGGGTTCC GCGCACATTT   8160
TCGCCTATGT ATAAACTTAC ATAAATCTTT TTATTTGTTT ATCCCCAAGG CGCGTGTAAA   8160

C                                                                   8161
G                                                                   8161
```

FIG.13B-11

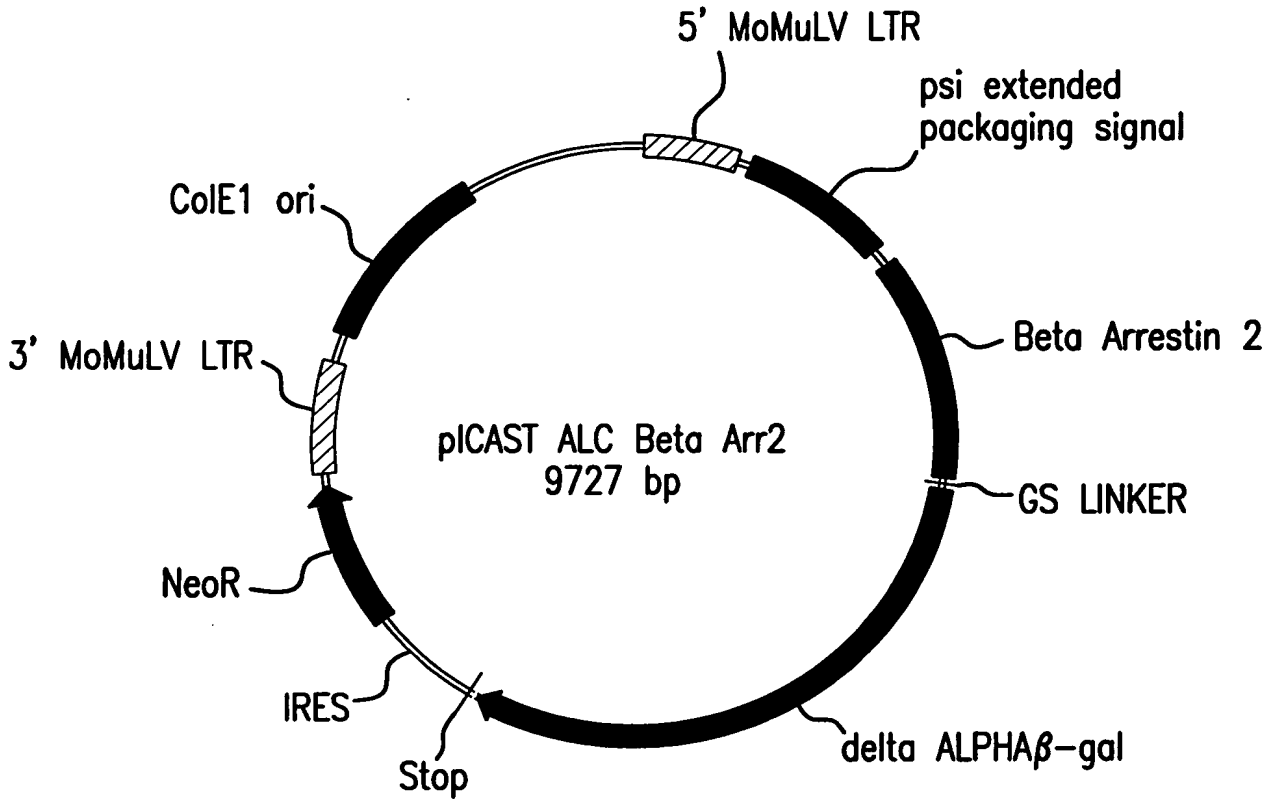


FIG.14

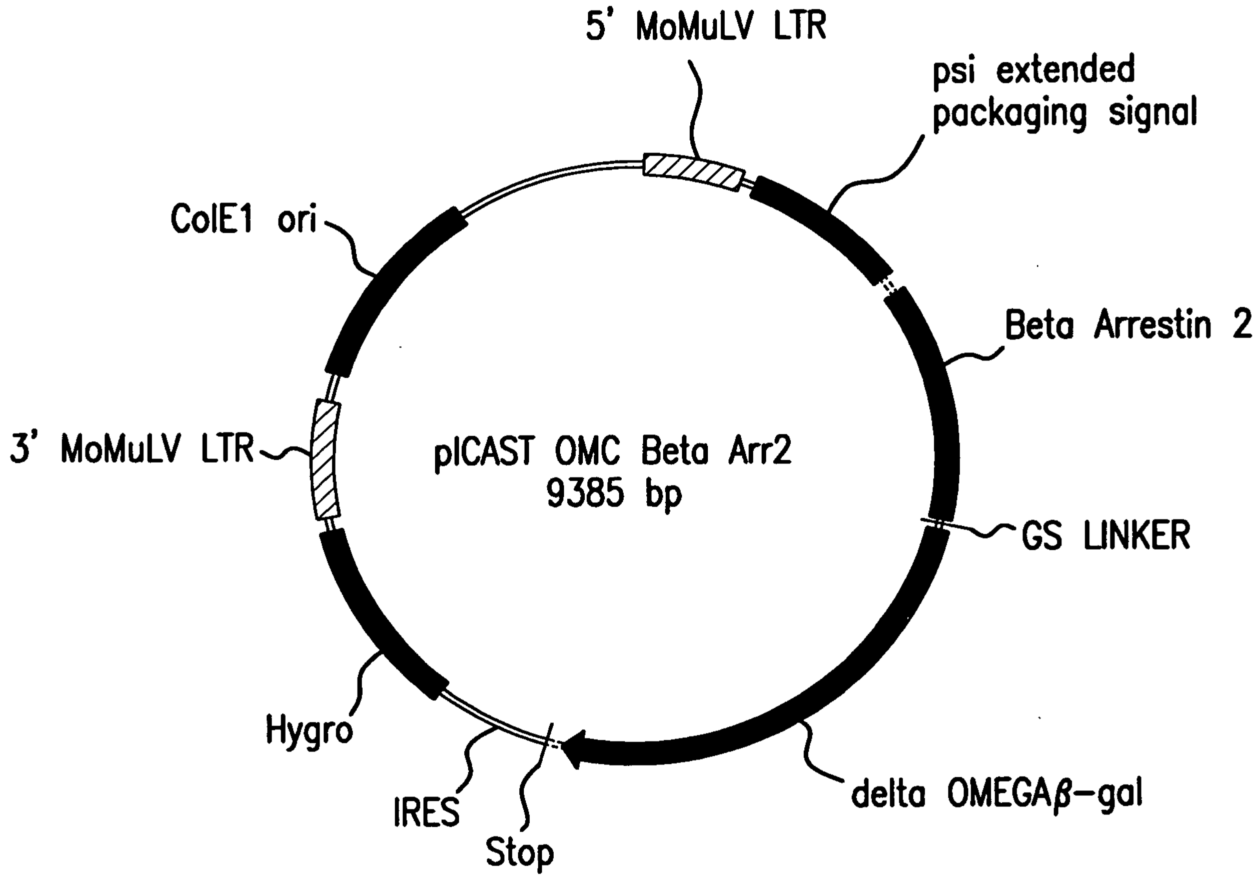


FIG.15

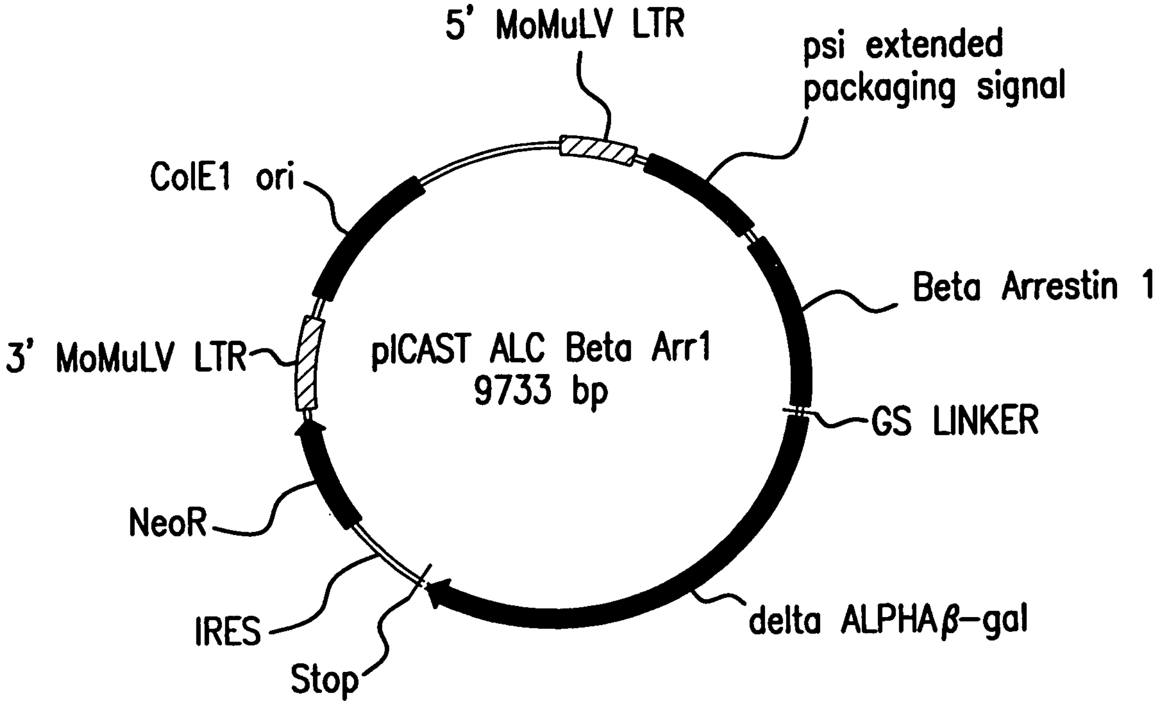


FIG.16

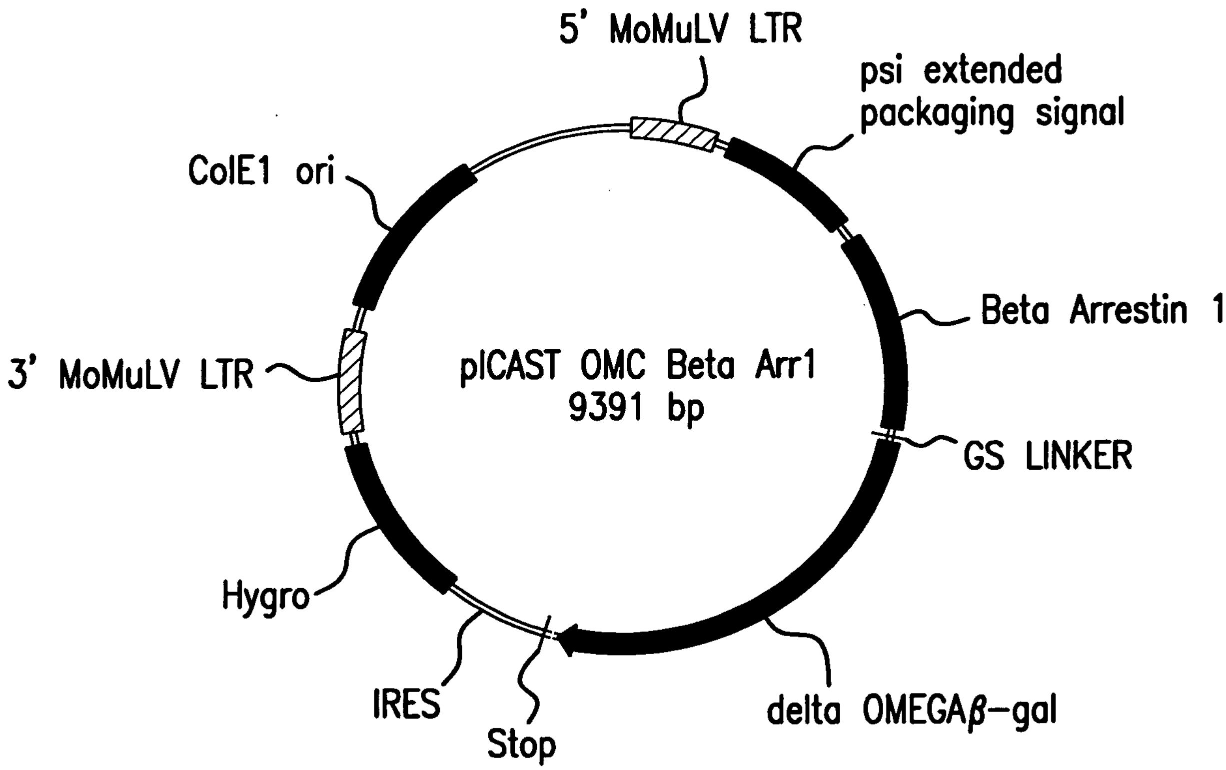


FIG.17

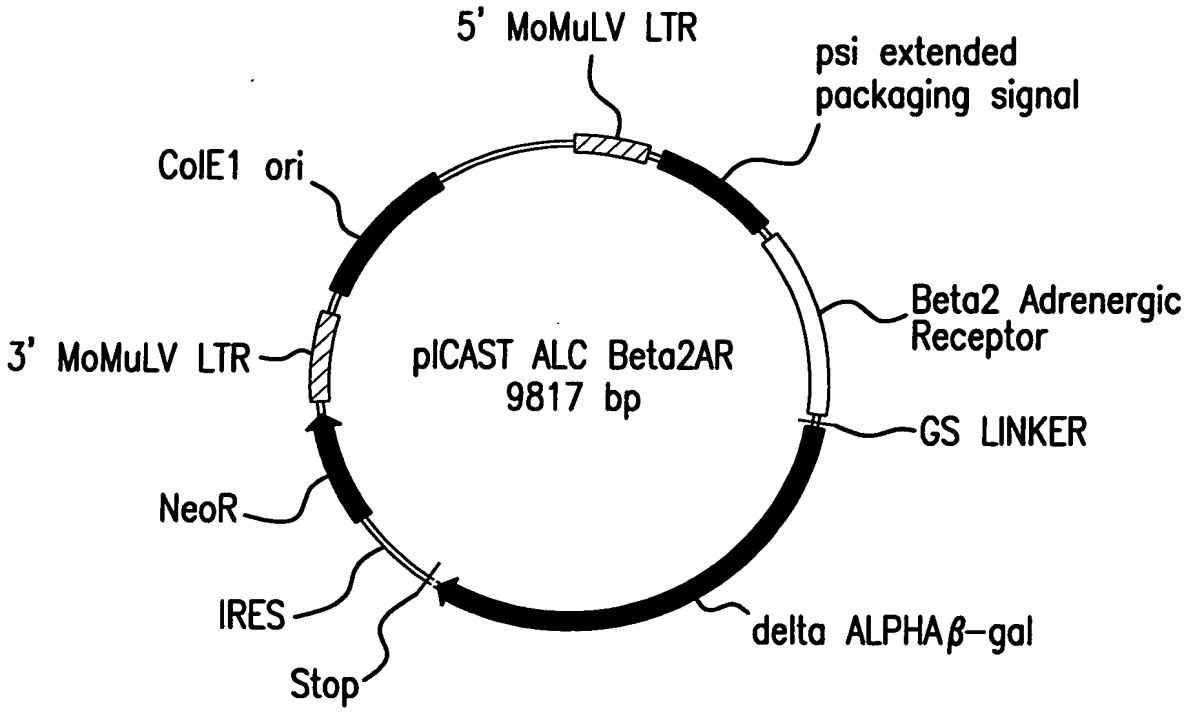


FIG.18

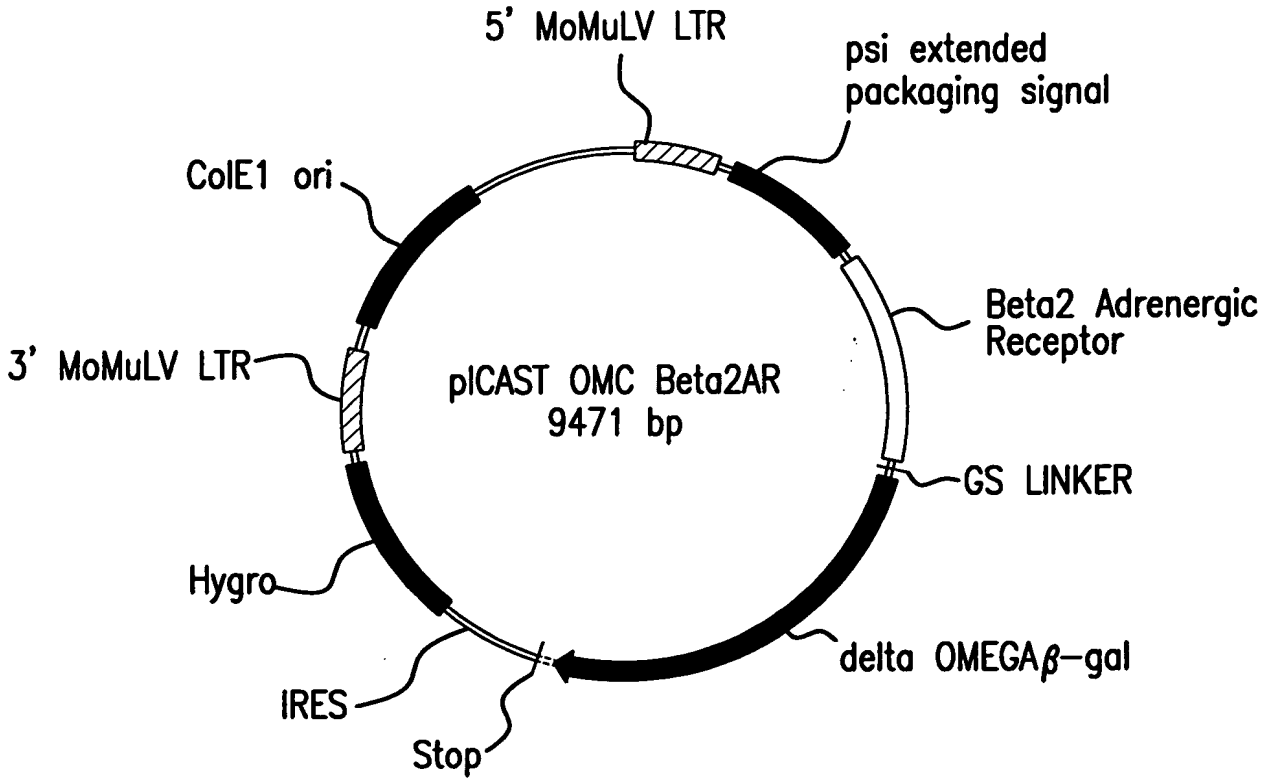


FIG.19

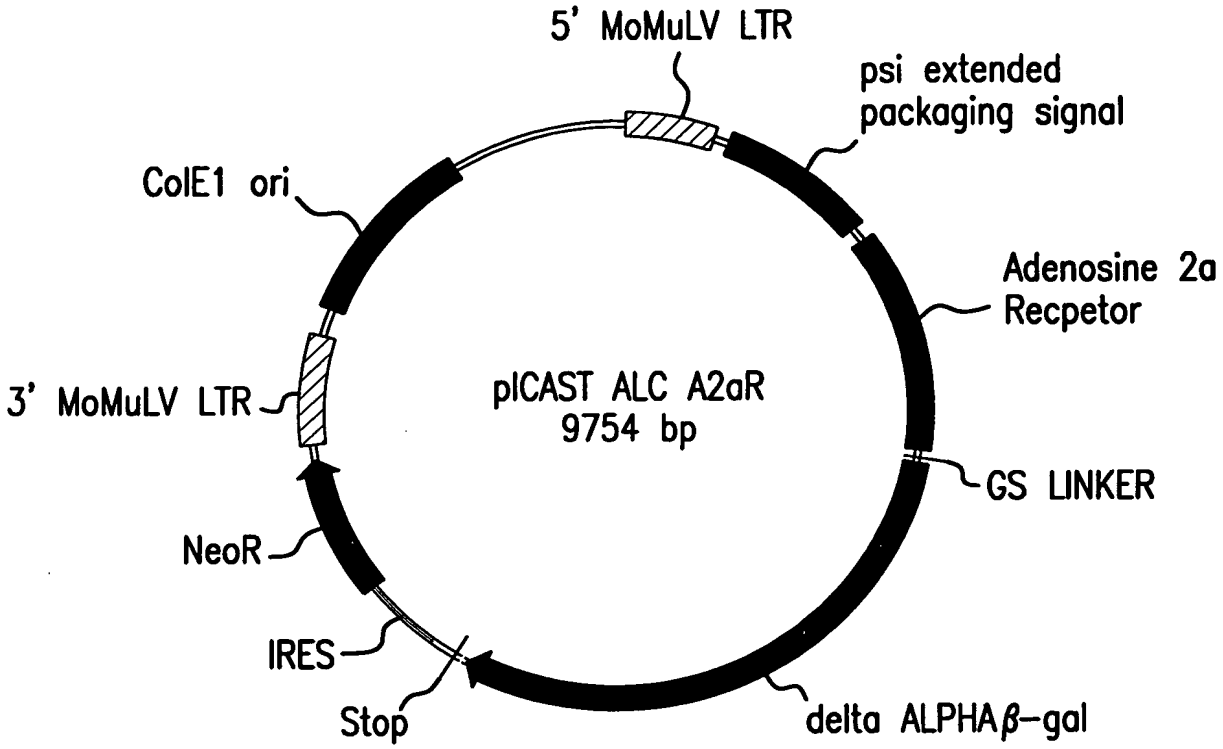


FIG.20

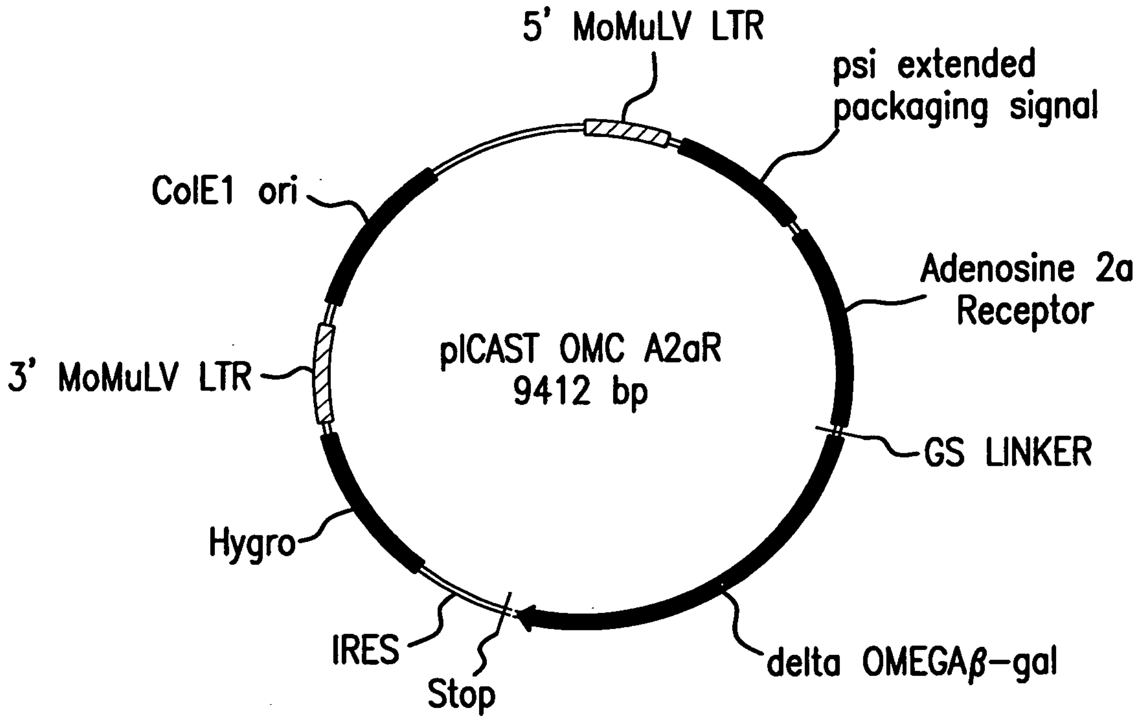


FIG.21

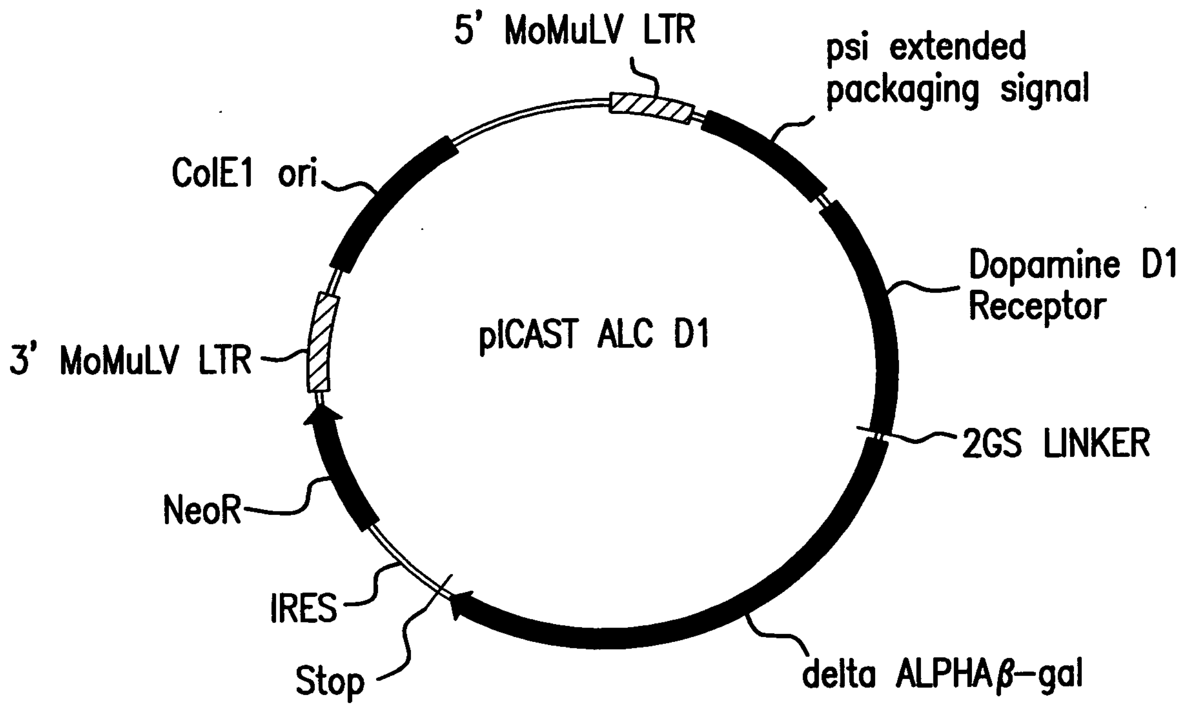


FIG.22

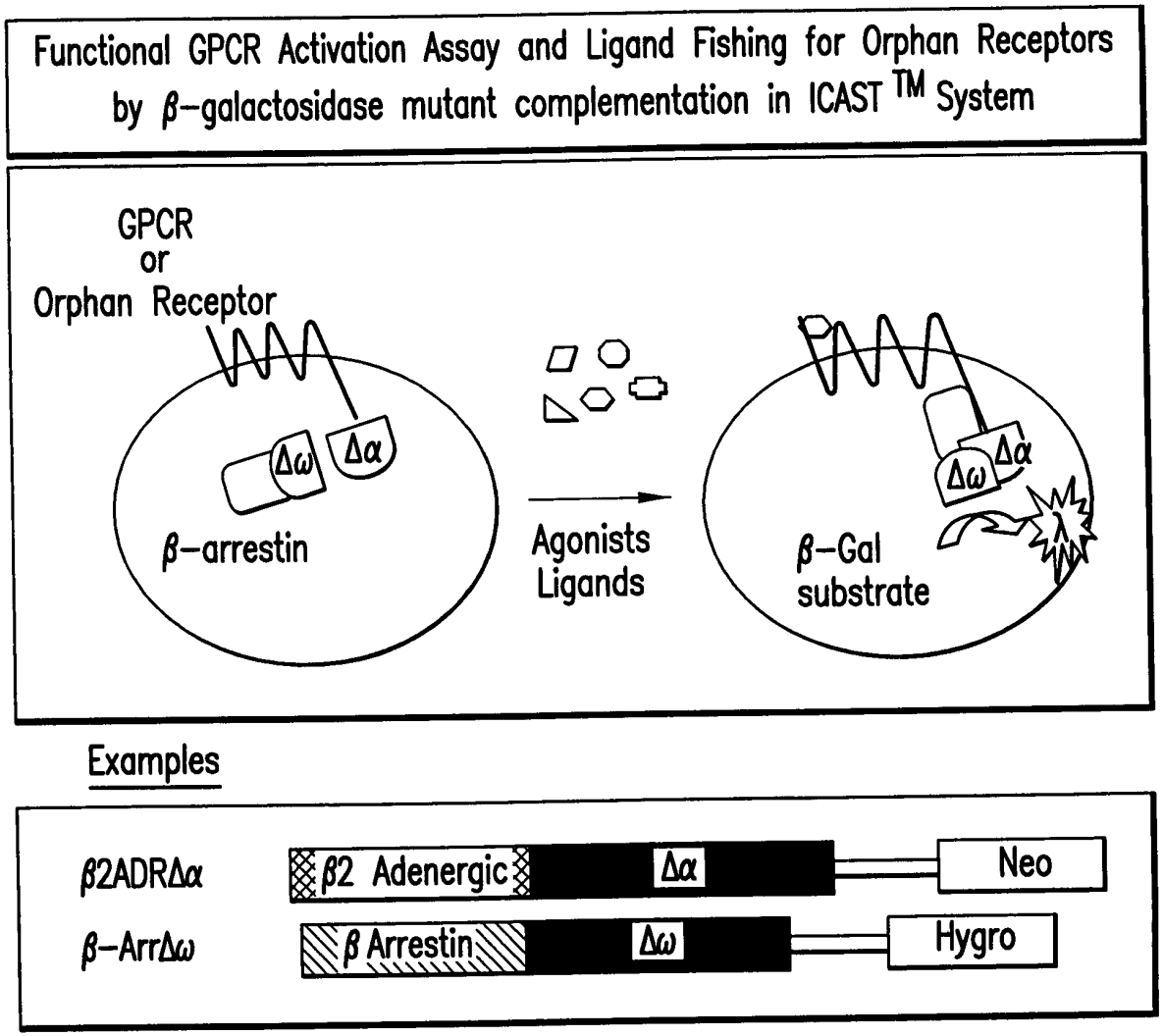
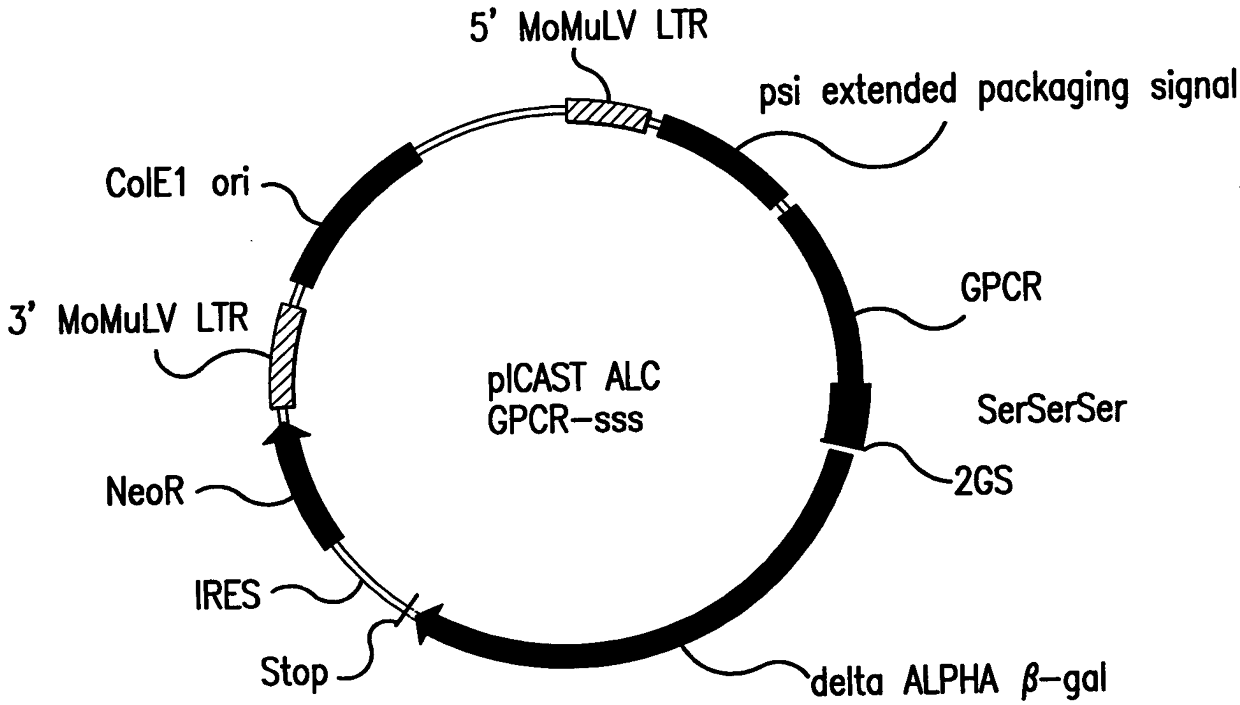
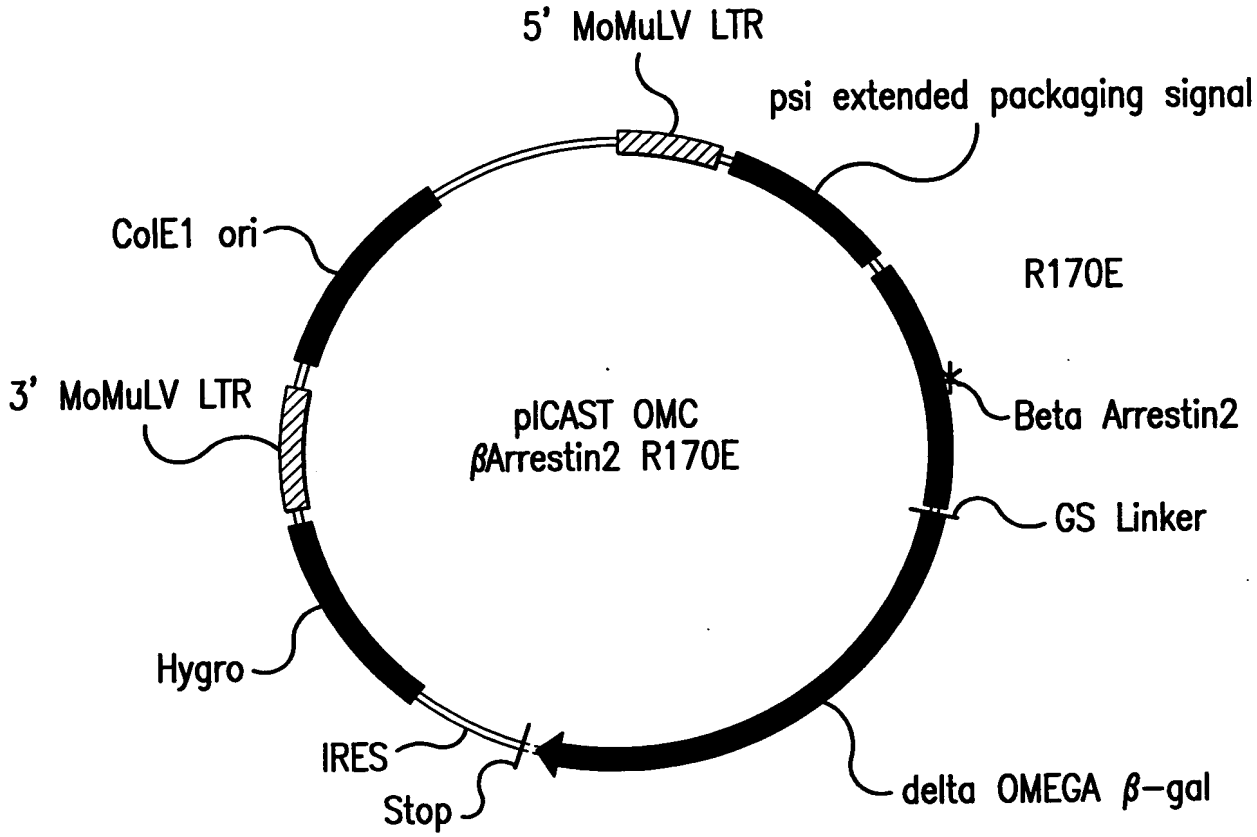

Functional GPCR Activation Assay and Ligand Fishing for Orphan Receptors by β-galactosidase mutant complementation in ICAST ™ System
GPCR or Orphan Receptor
Δω
Δα
β-arrestin
Agonists Ligands
β-Gal substrate
Examples
β2ADRΔα
β2 Adenergic
Δα
Neo
β-ArrΔω
β Arrestin
Δω
Hygro

FIG. 23



Vector for Expression of a GPCR with inserted Seronine/Threonine amino acid sequences as a fusion with β–gal Δα.

FIG. 24



Vector for Expression of mutant (R170E) β–arrestin2 as a fusion with β–gal Δω.

FIG. 25

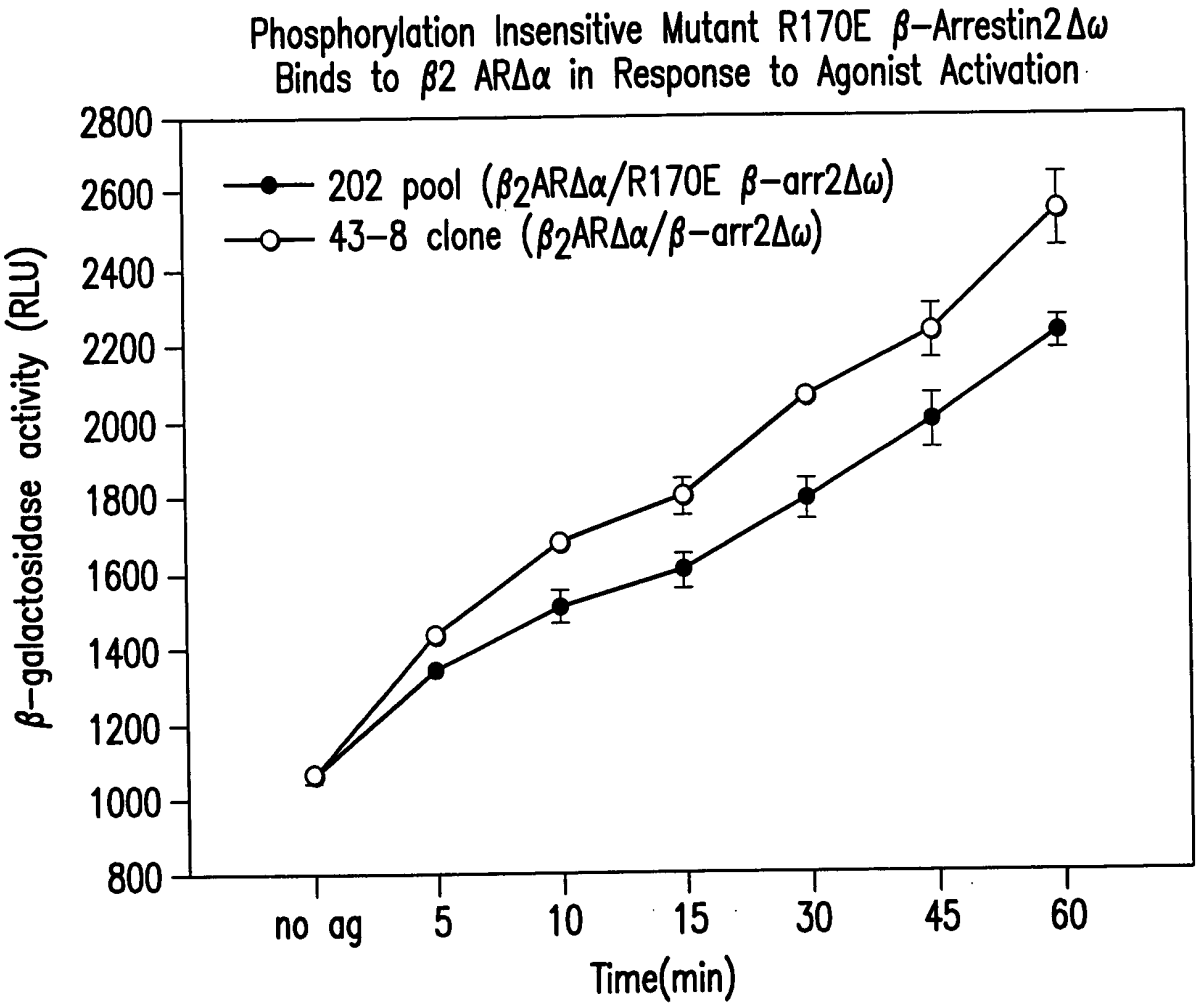
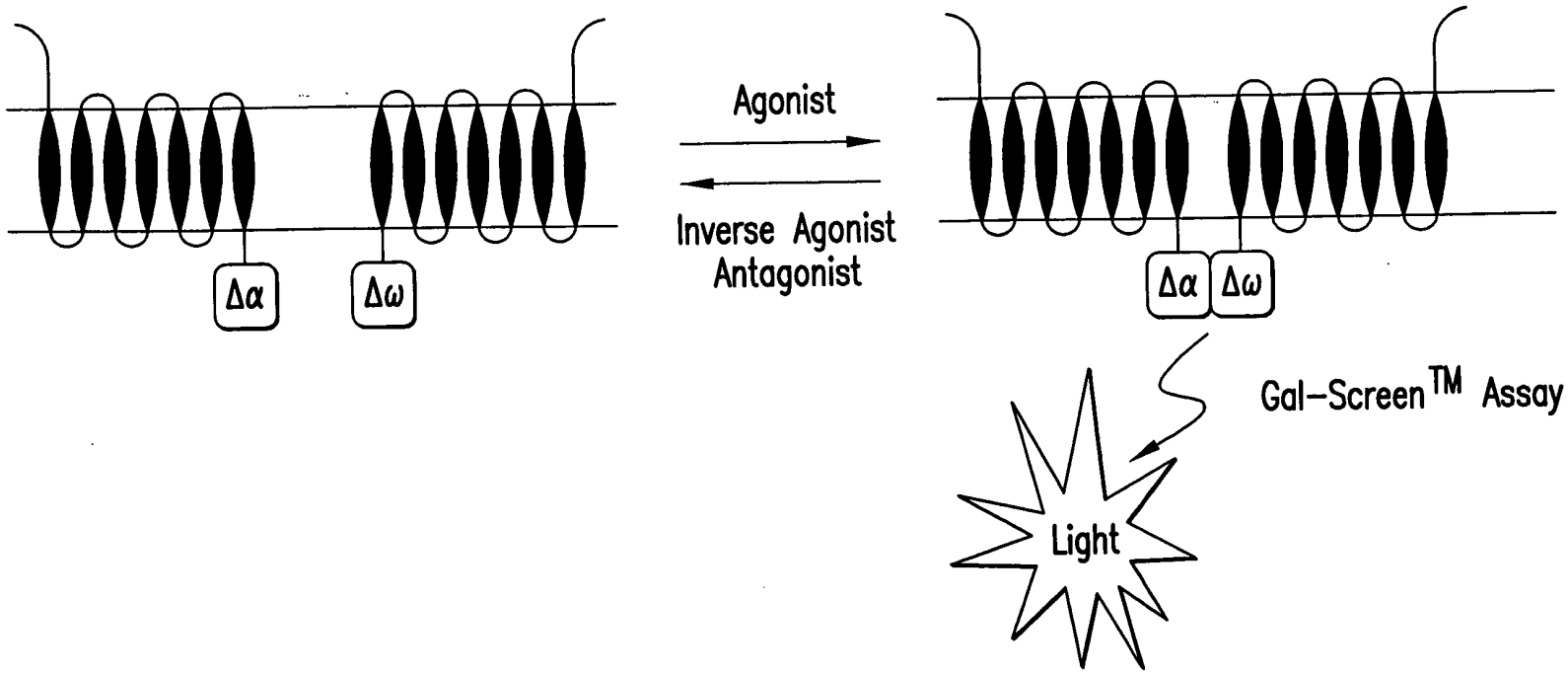

Phosphorylation Insensitive Mutant R170E β–Arrestin2 Δω
Binds to β2 ARΔα in Response to Agonist Activation
202 pool (β2ARΔα/R170E β–arr2Δω)
43–8 clone (β2ARΔα/β–arr2Δω)
β–galactosidase activity (RLU)
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
no ag
5
10
15
30
45
60
Time(min)

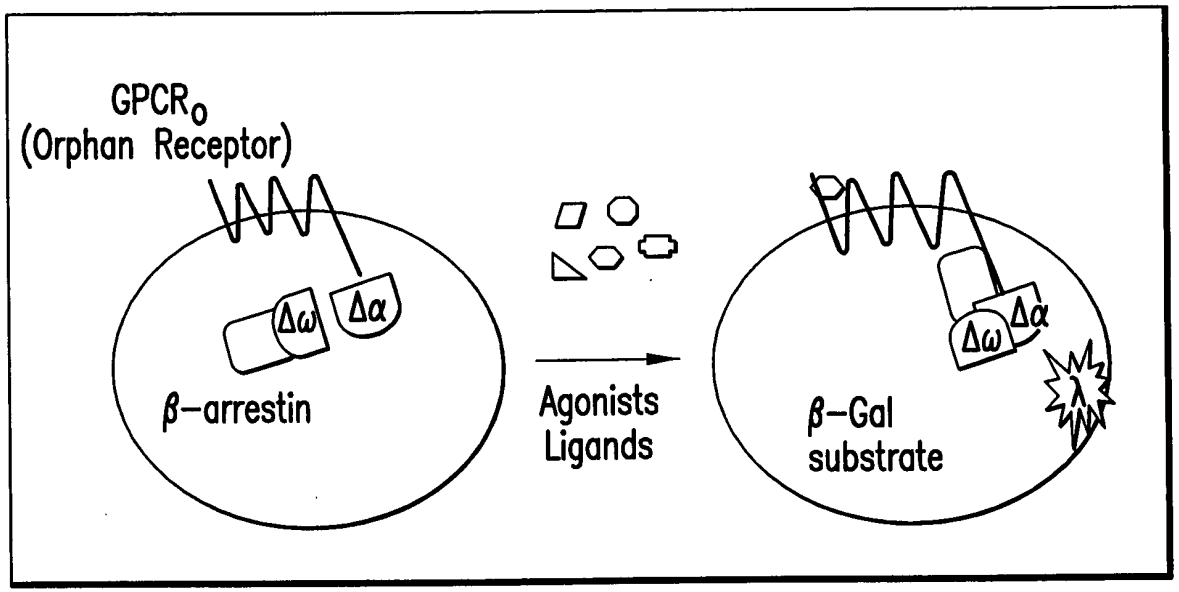
FIG. 26

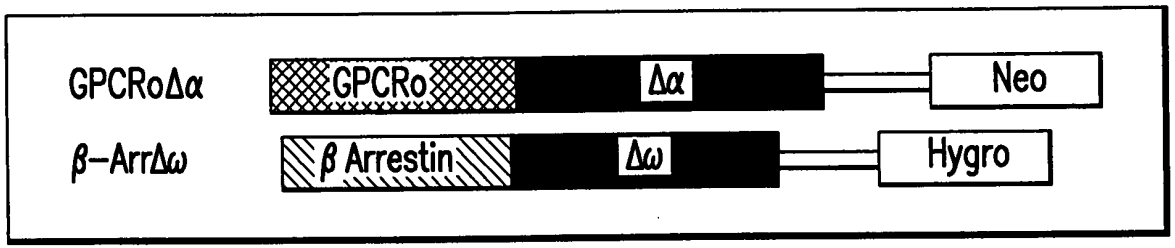


GPCR dimerization measured by β-gal complementation

FIG. 27

Example–





Ligand Fishing for Orphan Receptors by β–galactosidase mutant complementation in ICAST™ System

FIG. 28